ARMY, MARINE CORPS, NAVY, AIR FORCE

MULTISERVICE TACTICS, TECHNIQUES, AND PROCEDURES

MULTISERVICE PROCEDURES FOR NUCLEAR BIOLOGICAL, AND CHEMICAL (NBC) PROTECTION

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EXECUTIVE SUMMARY

Multiservice Tactics, Techniques, and Procedures
for
Nuclear, Biological, and Chemical (NBC) Protection

NBC Protection

Chapter I discusses NBC protection challenges.

Nuclear, Biological, and Chemical Protection (Before, During, and After Attack)

Chapter II addresses actions that can be taken before, during, and after an NBC attack. Because operations in an NBC environment can include TIM incidents, this chapter also addresses suggested protective actions that can be taken in response to a TIM event.

Operation In Unique Environments

Chapter III addresses how weather and terrain affect the needs for NBC protection. Certain weather conditions will greatly influence use of NBC weapons. Likewise, different types of terrain will alter the effects of NBC weapons. This chapter addresses cold weather, desert, jungle, mountain, urban, and littoral operations, respectively.

Sustained Operations in an NBC Environments

Chapter IV provides insights into the degradation to be expected from enemy employment of NBC weapons, and provides suggested guidance for maintaining operational tempo in the NBC environment. The basic goals remain to avoid or minimize the impact of the contamination and to enhance endurance and task performance. When individuals are encapsulated in these ensembles, they are subjected to both physiological and psychological stresses; however, given an understanding of the NBC environment and its impact and proper training, individuals can perform

assigned tasks successfully for a considerable period of time.

MOPP Analysis

Chapter V addresses the guidance for determining appropriate levels of protection in an NBC environment.

Individual Protection

Chapter VI provides a overview at the individual protection capabilities that are available and/or issued to the armed forces of the United States.

Collective Protection

Chapter VII addresses collective protection planning considerations. It also discusses collective protection capabilities such as fixed site, transportable, mobile, and naval collective protection.

NBC Protection Equipment

Appendix A describes items such as protective clothing, masks, TIM protective equipment, decontamination, detection, medical and other related items (i.e., chemical agent monitors/alarms, and radiac equipment/dosimeters).

Collective Protection (Guidelines For The NBC Portion of a

Collective Protection SOP and Entry/Exit Procedures)

Appendix B provides example information that could be used to help prepare a collective protection system SOP, shelter entry/exit procedures, and shelter preparation and operation.

Human Factors Effects Mission Oriented Protective Posture

Appendix C provides information on the physiological and psychological stress incurred while wearing the BDO or the JSLIST.

Radiological Protection (Operational Exposure Guidance, Low Level Radiation Exposure, Depleted Uranium)

Appendix D provides information and data on use of operational exposure guidance (OEG). It also addresses how radiation exposure can create casualties and must be monitored as another critical element of the commanders force health protection program. Finally this appendix addresses low level

radiation exposure and depleted uranium considerations.

Toxic Industrial Chemicals An Assessment of NBC Filter Performance

Appendix E provides information and data on the assessment of NBC filter performance as they relate to protection against selected toxic industrial chemicals (TIC). The filter performance provides supporting information to support planning activities.

Noncombatant Evacuation Operations

Appendix F provides basic information on NBC protection for NEO operations.

NBC Defense Equipment National Stock Numbers

Appendix G provides basic information (National Stock Numbers) for selected items of NBC defense equipment.

PREFACE

1. Scope

This publication is designed for use at the tactical and operational level. It defines the roles of military units and staffs involved in planning and executing military operations in a possible nuclear, biological, and chemical (NBC) environment. This manual provides multi-service tactics, techniques, and procedures (MTTP) for NBC protection. The manual will address individual and collective protection considerations for protection of the force. The document also addresses civilian personnel protection considerations. The document focuses on the need for all US forces to be prepared to fight in a NBC environment. The document addresses the risk management that occurs to determine what NBC protection measures could be considered to mitigate the risk of operations in a NBC environment. The planning and coordination for NBC protection takes place with the realization that the potential NBC environment could be one in which there is deliberate or accidental employment of NBC weapons, deliberate or accidental attacks or contamination with toxic industrial materials (TIM), or deliberate or accidental attacks or contamination with radiological materials (see Joint Publication [JP] 3-11).

2.

This publication, provides a reference for NBC protection, bridges the gap between service and joint doctrine, and contains tactics, techniques, and procedures (TTP) for planning and executing operations in a NBC environment. This manual addresses concepts, principles, and TTP, to include planning, operational considerations, and training and support functions. It serves as the foundation for development of multi-service manuals and refinement of existing training support packages (TSPs), mission training plans (MTPs), training center and unit exercises, and service school curricula. It drives the examination of organizations and materiel developments applicable to NBC protection.

3. Application

The audience for this publication is combatant command, joint task force (JTF), functional and service component units and staffs in foreign and domestic locations that could be challenged by operations in a NBC environment.

4. Implementation Plan

Participating service command offices of primary responsibility (OPR) will review this publication, validate the information, reference, and incorporate it in service and command manuals, regulations, and curricula as follows:

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5. User Information

a. The US Army Chemical School developed this publication with the joint participation of the approving Service commands.

b. This publication reflects current service and joint doctrine, command and control (C^2) organizations, facilities, personnel, responsibilities, and procedures.

c. We encourage recommended changes for improving this publication. Key your comments to the specific page and paragraph and provide a rationale for each recommendation. Send comments and recommendation directly to—

Army

Commandant
US Army Chemical School
ATTN: ATSN-CM-DD
401 MANSCEN Loop, Suite 1029
Fort Leonard Wood MO 65473-8926
COMM (573) 596-0131 ext. 3-7364

Marine Corps

Commanding General
US Marine Corps Combat Development Command
ATTN: C42 (Director)
3300 Russell Road
Quantico VA 22134-5001
DSN 278-6234 COMM (703) 784-6234

Navy

Commander
Navy Warfare Development Command
ATTN: N5
686 Cushing Road
Newport, RI 02841-1207
DSN 948-4201 COMM (401) 841-4201

Air Force

HQ Air Force Doctrine Center
ATTN: DJ
216 Sweeney Boulevard Suite 109
Langley AFB VA 23665-2722
DSN 574-8091 COMM (757) 764-8091
E-mail Address: afdc.dj@langley.af.mil

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US Training and Doctrine Command
Fort Monroe, Virginia

USMC 3-37.2

Marine Corps Combat Development Command

Quantico, Virginia

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Newport, RI

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Headquarters Air Force Doctrine Center
Maxwell Air Force Base, Alabama

Multiservice Tactics, Techniques, and Procedures for

FIGURES

TABLES

Chapter I
NBC PROTECTION

This chapter discusses basic NBC protection fundamentals, protection planning, basic planning considerations for protection of the force, NBC preparedness, and the components of NBC protection.

1. NBC PROTECTION-BASIC FUNDAMENTALS

a. Background. There are selected basic fundamentals that impact NBC protective actions that include – conducting intelligence preparation of the battlespace, providing exposure guidance, conducting risk assessment, establishing protection requirements, implementing protective actions, sustaining protective actions, monitoring for conditions requiring changes to protective actions (supervision and evaluation), ensuring warning and dewarning of personnel (i.e., unmasking), and conducting medical surveillance.

b. Intelligence Preparation of the Battlespace (IPB). The continuous IPB process must account for confirmed as well as plausible but unconfirmed adversary capabilities, plans, and actions. The commander must take into account these potential adversary NBC capabilities in assessments, estimates, and plans. The NBC staff uses the IPB process and addresses (in coordination with the intelligence section) the capabilities and limitations of adversary NBC weapons and delivery systems; their command, control, and release procedures; the indicators of intent to employ NBC weapons; and the identification of possible TIM in areas of operations. The NBC staff must understand adversary weapons capabilities and effects. For example, the primary threat from a theater ballistic missile (TBM) is the warhead. TBM warheads are designed and fused to optimize the effect of the warhead fill.

(1) Conventional warheads are designed to explode upon or shortly after impact with the ground while a nuclear warhead may be fused for an air, ground or subsurface burst. The very high missile speed at impact and a 600-1000 pound conventional warhead combine to produce a devastating explosion at the point of impact. Significant damage will occur to buildings and utilities within the immediate area and a large impact crater is likely.

(2) Airburst warheads provide the most effective area coverage and dispersion pattern for chemical and biological agents. When released at optimal burst heights, the agents will fall to the ground over the next 5 to 60 minutes in the direction of the prevailing wind. Larger agent droplets or solids will generally fall more quickly while smaller droplets will fall further downwind at a slower rate. Similarly, the vapor released as these agents

evaporate will move from the point of release toward the ground and in a downwind direction.

(3) Downwind hazards from biological agent filled warheads produce significantly greater downwind hazards than chemical warheads.

(4) Ground burst chemical and biological agent filled warheads create a much smaller hazard footprint. Most of the agent effectiveness will be lost from the force of warhead impact. The small amount of liquid or particulate agent that survives the impact will be found in or near the crater.

(5) Secondary threats may also exist during and after some TBM attacks. TBMs such as the SCUD and SCUD variants have warheads that do not separate from the missile body but remain together until the missile warhead functions or the missile impacts the ground. Even if the warhead functions or is hit with an anti-ballistic missile, the missile components continue on a ballistic trajectory and impact the ground. In addition to potential explosive, chemical or biological hazards, the missile may impact a building or create a crater. The impact site may contain hazards from the remaining missile fuel and oxidizer or from the facility or structure the missile hit (fuel, power lines, munitions, etc.). Personnel in MOPP 4 are protected from potential chemical and biological hazards but are not fully protected from the unused or unburned missile oxidizers and fuel hazards. Depending on the quantity remaining, the residual fuel and oxidizer (red fuming nitric acid) present a potential toxic chemical hazard to personnel. These chemicals may also cause M8 paper to falsely indicate the presence of agent or mask the presence of the actual agent.

c. Exposure Guidance. Exposure to NBC warfare agents or TIM may occur through inhalation, ingestion, or skin contact. Such exposure may have significant immediate or even prolonged health effects. However, the goal is to preclude any exposure or to keep the exposure as low as reasonably achievable. These health effects may adversely impact mission performance and/or may result in disease and non-battle injury. As such, risk exposure must be assessed and integrated into overall military operational risk management. Typical scenarios for potential battlefield exposure to agents could include -

- Downwind hazard from adversary's attack.
- Collateral damage from adversary's NBC storage facilities.
- Vapor off-gassing from material, or surfaces in a previously contaminated area.

(1) The preventive medicine (PVNTMED) and NBC planners provide essential staff support to the commander on the hazard from TIM and NBC warfare agents. The PVNTMED planners carefully analyze the medical threat and also evaluate the environmental health risks in the area of operations. The NBC planners assess the NBC threat, and both planners also coordinate with their unit's intelligence section.

(2) The exposure guidance furnished will depend on factors that include – the sensitivity of the exposed individual, the duration of exposure, the concentration of the substance, and the combination of substances to which the individual is exposed.

(3) The sensitivity of individuals and exposure duration affect the severity and characteristics of toxic effects that may be experienced by exposed individuals. A short exposure to a NBC agent or TIM may produce only minimal adverse effects such as mild irritation; whereas, longer exposure to the same toxic material concentration may produce more severe effects which could interfere with mission function. The first indication of exposure to NBC agents or TIM will likely be noticeable symptoms.

(4) Exposure frequency and concentration are often critical factors in estimating severity and onset of casualty producing effects from exposure. Exposure frequency describes how often individual exposures have occurred during a specific time period.

(5) Additionally, increased physical workload in a deployed military population may actually increase the probability of occurrence and the severity of casualty producing effects, because factors like breathing rate increase as workload increases leading to an increased uptake of NBC agents or TIM.

(6) The period of time personnel may be exposed to NBC warfare agents or other hazards cannot be precisely estimated. However, the duration periods described in Table I-1 provide generalized duration of exposures that deployed forces may encounter. (see Table I-1).

Table I-1. Generalized Designations of Exposure Duration (Example)

Temporary Exposure Duration	An exposure that reflets a brief, one-time occurrence. Such an occurrence may only last minutes or up to a few hours.
Short-term Exposure Duration	In general, this term applies to exposures that exceed the " temporary" duration and continue daily up to a two-week period. This includes continuous exposures and repeated, intermittent exposures.
Long-term Exposure Duration	Long-term exposures include continuous exposures or repeated, intermittent exposures that continue daily for more than a 2-week duration.

d. Risk Assessment.

(1) Vulnerabilities should be examined through comprehensive risk assessments. Commanders have multiple means to contain, mitigate, and manage the consequences of identified risks. In order to preserve combat power and minimize casualties, commanders –

- Identify hazards.
- Assess hazards to determine risks.
- Develop controls and make risk decisions.
- Implement controls.
- Supervise and evaluate.

(2) When US, host nation (HN), or other civilian populations and infrastructures are at risk to NBC attack, the commander assists the appropriate military and civil authorities to protect against, mitigate, and manage the consequences of these risks.

(3) Risk assessment also addresses the dangers posed by toxic materials, including radiological contamination and other environmental contamination. The presence of TIM may derive from industrial operations within the operational area. Particular care must be taken in identifying the nature of such hazards, because in many cases standard military NBC individual protective equipment (IPE) will not provide the necessary protection. In some instances, avoiding the hazard may be the most effective or only course of action (COA). In all circumstances, the unit should act to minimize immediate and long-term effects of toxic hazards to health.

(4) Control measures can be taken to eliminate or minimize exposure over a wide range of actions. Example control measures could include representative NBC defense measures such as:

- Ensuring pre-deployment vaccination and prophylaxis.
- Moving operations (e.g., relocating a base camp).
- Managing deployment length.
- Managing work schedules and limiting shift duration.
- Managing personnel rotation on high risk missions.
- Monitoring and conducting surveillance of potential threat risks.
- Briefing commanders and service personnel on potential threats, and safe and appropriate responses.
- Enforcing correct wear of uniform.
- Enforcing personal hygiene standards.
- Isolating an operation by means of barriers or enclosures.
- Shielding a radiation source.
- Using MOPP gear.

e. Establishing Coordinated NBC Defense Plan Protection Requirements. Commanders direct establishment of coordinated NBC protection requirements through preparation of NBC defense plans. This kind of action is common across the various components and includes but is not limited to, dispersing and networking available detectors, designating NBC warning and reporting requirements, implementing periodic sampling and analysis, and designating shelters for applicable personnel, if applicable. There are other NBC defense protection requirement that may include –

(1) Ensuring interoperability among components in the exercise of key mission tasks (i.e., warning and reporting, etc.).

(2) Exercising the NBC defense plan as part of an integrated exercise.

(3) Using input from the theater missile defense (TMD) warning system to ensure connectivity and the rapid dissemination of information.

(4) Validating existing plans with regard to key elements such as sustaining the force's (i.e., resupply of NBC defense equipment; contract logistics support for critical commercial off the shelf NBC defense equipment) capability to operate in an NBC environment.

(5) Exercising the evacuation of suspect NBC samples to labs, or testing the warning and reporting system to warn or dewarn selected units.

f. Implementing Protective Actions.

(1) Leaders and staffs implement protective actions by ensuring that protective actions (i.e., minimum MOPP level, dewarning, etc) are integrated into SOPs, written and verbal orders, mission briefings, and staff estimates. The critical check for this step, with oversight, is to ensure that required actions (controls) are converted into clear, simple execution orders. Implementing actions includes coordination and communication with agencies such as higher, adjacent, and subordinate units and those executing the mission.

(2) Leaders also understand the impact of implementing protective actions. Examples of implementation include:

- Conducting rehearsals and wargaming of possible COAs.
- Conducting intensive threat refresher training.
- Conducting NBC defense training for replacement personnel.
- Installing and maintaining communications links for military and key civilian organizations.
- Continually assessing personnel, operational, and logistics readiness.
- Carry and maintaining IPE.

g. Sustaining Protective Actions. Leaders ensure actions are taken to equip and train US military and emergency essential civilian personnel. Deployable personnel are fitted with appropriate IPE. (otherwise they are declared nondeployable). Sustainment also ensures that adequate supplies (i.e., detection and decontamination kits, mask filters, medical, tims, etc) are available and required maintenance is conducted.

h. Supervision and Evaluation. During mission preparation and execution, leaders conduct risk assessment to continuously evaluate and assess risk levels that may yield lessons learned and/or identification of new hazards. Leaders supervise mission rehearsal and execution to ensure standards and controls are maintained. Techniques may include spot-checks, inspections, situation reports and brief-backs, buddy checks, and close supervision. Leaders must ensure that personnel do not relax their vigilance due to performing repetitive tasks; despite changing roles and missions, and unit turbulence and turnover.

i. Warning and Dewarning. The NBC warning and reporting system (NBCWRS) provides the data and information to inform leaders of important information requirements. Key information requirements that can be derived from NBCWRS can include –

(1) Time and place of attack.

(2) Who was affected.

(3) Impact of the attack.

(4) Type and extent of hazard.

j. Medical Surveillance. Before and during deployment, service members are made aware of the significant health threats and corresponding medical prophylaxis, immunization and other unit and individual countermeasures for the area of operations. Commanders provide their personnel the appropriate medical support and training, equipment and supplies to implement unit and individual countermeasures. Once deployed, personnel are provided updates to health threats and countermeasures based upon need and situations encountered.

2. PLANNING

1. The armed forces of the United States must be prepared to conduct prompt, sustained, and decisive operations in NBC environments. An adversary's NBC capabilities can have an impact on a commanders objectives, plans, and supporting actions, and therefore must be taken into account at the strategic, operational, and tactical levels. The planning process basically remains the same across the range of military operations, regardless of the level of war. Nevertheless, specific NBC defense protection considerations may vary considerably between strategic, operational, and tactical-level operations due to differences in mission, available resources, and size of the operational areas.

a. Strategic-Level NBC Defense Protection Planning. The strategic-level planning will address potential adversaries who might have NBC capabilities such as global adversaries, regional adversaries or nonstate groups. A number of these potential adversaries have, or could rapidly acquire, NBC weapons and other toxic materials. Other planning considerations include providing force protection (i.e., minimum MOPP level) and exposure level guidance.

b. Operational-Level NBC Protection Planning. At the operational level, planning could concentrate on characteristics such as the capability of road, rail, air, and sea transportation networks to support the movement of adversary NBC weapons; zones of entry into and through the operational area and area of interest (AOI); the impact of large geographic features such as mountains, large forests, deserts, and archipelagos on military operations; and seasonal climatic efforts on NBC weapons effects. Operational level planning also further refines protection guidance and integrates the theater-wide warning and reporting system.

c. Tactical-Level NBC Defense Protection Planning. Tactical level planning focuses on ensuring that commanders can accomplish their mission essential task in NBC environments. At the tactical level, the size and location of the battle space are influenced by the physical location of adversary land, air, naval, space, and other forces that could pose a direct threat to the security of the friendly force or the success of its mission. The extent to which the effects of the battle space environment are analyzed at the tactical level is largely dependent on the mission and planning time available. Tactical level planning continues to address risk management, protective actions, changing conditions, warning and dewarning personnel, and medical surveillance.

3. PROTECTING THE FORCE

a. Background. Fundamentally, protecting the force consists of those actions taken to prevent or mitigate hostile actions against personnel, resources, facilities, and critical information. These actions conserve the force's fighting potential so that it can be decisively applied. In NBC environments, the commander must take into account a number of unique considerations that have a significant effect on force protection. As depicted in Figure I-1, these include but are not limited to commander's intent, training and leader development, psychological operations (PSYOP), force health protection, protective equipment, and operations security (OPSEC).

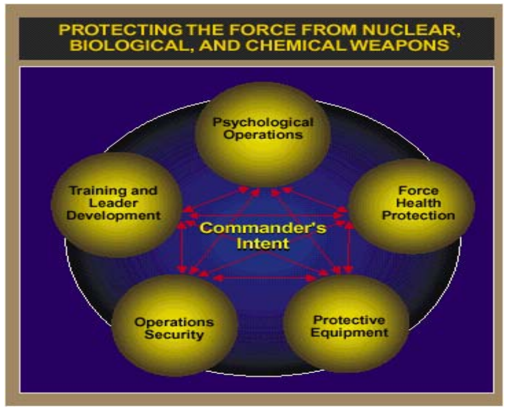


Figure I-1. Protecting the Force from Nuclear, biological and Chemical warfare

b. Commanders Intent. The commander conducts risk assessment and outlines what his unit must do to succeed with respect to the enemy and to the terrain and to the desired end state. The intent outlines the key tasks that must be performed. Risk is stated in the commander's guidance and is addressed in all COAs.

c. Training and Leader Development. Rigorous and realistic individual and joint unit training across the force ensures readiness to fight and win should an adversary employ NBC weapons. Training, exercises, and professional military education and leader development programs should incorporate the principles for operations in NBC environments and include realistic consideration of NBC weapons effects on sustained combat operations.

d. PSYOP. As a means to minimize the potential for and mitigate the effects of adversary NBC use, PSYOP can decrease an adversary's perception of the utility of NBC weapons, contribute to deterring their employment, and enhance efforts to reduce an adversary's domestic and international support.

e. Force Health Protection. Medical protection of the force against NBC threats involves integrated preventive, surveillance, and clinical programs. The commander's plans should include preventive medicine, joint medical surveillance, NBC casualty control, medical evacuation, and provision for readily available treatments and supplies to counter the physical effects of NBC exposure.

f. Protective Equipment. Sufficient equipment must be available to protect not only the uniformed force but also the essential supporting US and civilian work forces. Individual and unit training for proper sizing, use of, and care for individual and crew-served equipment is required to take full advantage of its capabilities.

g. OPSEC. In affecting an adversary's intelligence and situational awareness, information operations including OPSEC provide forces with significant measure of protection by preventing an adversary from acquiring information necessary to successfully target forces and facilities. Deception, dispersion of forces, and effective use of terrain are examples of measures that complement OPSEC.

4. NUCLEAR, BIOLOGICAL, AND CHEMICAL PREPAREDNESS

2. Varied and unpredictable challenges to US interests in the international security environment require adequate preparedness in peacetime to facilitate rapid transition to operations.

a. Preparedness in the United States.

(1) Commanders of forces and facilities in the United States assess vulnerabilities that may compromise peacetime preparedness. A number of state and non-state adversaries may choose early NBC employment against the US civilian population and infrastructures as well as military forces and facilities. Therefore, peacetime preparedness and planning for transition to operations accounts for the vulnerabilities that, if exploited by adversaries, could impede execution of mission-essential tasks.

(2) Peacetime planning and supporting actions must include plans to minimize vulnerability to and mitigate the effects of NBC attacks in order to maintain required force preparedness. Commanders coordinate with civilian authorities and agencies to prevent and, if necessary, mitigate and manage the consequences of deliberate or accidental NBC employment or similar toxic material events in the United States. Detailed interagency processes guide the Armed Forces of the United States in providing military support to civil agencies to cope with such events.

b. Preparedness in Theater Operational Area. Peacetime preparedness for operations in NBC environments includes measures taken by commanders at intermediate staging bases or in theater operational areas abroad. Force requirements (including readiness and force protection) in any particular combatant command area may require support not only from the United States but also from other combatant commands.

c. Preparedness – "Using all the Tools" (NBC Information Management).

(1) Commanders require accurate and timely information as they prepare for operations in an NBC environment. Decisions rely on situational awareness and an understanding of the significance of the information (i.e., impact of degradation on the force). Units translate all-source information into an understanding of the NBC threat and the operational

(2) environment. Commanders and staff conduct timely risk assessments; and recommend specific courses of action for reducing risk and countering specific threats. To maintain situational awareness, units use information from sources such as the NBC warning and reporting system to report on potential and actual NBC attacks.

(3) Units obtain relevant data (See Figure I-2) from multiple sources (i.e., sensors, detectors, other reconnaissance and surveillance assets, etc.). The appropriate data (i.e., type of agent, time of detection, weather data, location, etc.). is processed, extracted, formatted, and forwarded. Commanders and their staff evaluate the information to assess its impact on operations. The risk assessment then may lead to directive/orders to help mitigate the impact of the assessed hazard. Commanders may direct an integrated series of protective (i.e., increased MOPP posture) measures to decrease the level of risk (i.e., decrease exposure opportunity). Further, situational awareness is an ongoing process, and as updated information is received the plan is revised.

(4) The command and staff conduct preplanning to determine critical data requirements. The revelant choices are prioritized as priority information requirements and a data collection plan is prepared. The overall data collection efforts shares common characteristics:

- Connectivity from lower-to-higher and with adjacent units.
- Ability to forward revelant data to multiple, echelons of command simultaneously.
- “Reachback” capability to obtain access to national-level intelligence, operational, logistics, or technical information.

(5) Units receive, process, and evaluate data received. Data received will be incomplete, therefore data is assessed and evaluated in light of information from other sources. The available data is synthesized to assess its operational significance. The

evaluated information may result in no action being taken; or the information received may be translated into an input that affects the military decision making process (MDMP).

(6) The evaluated information is used to support the MDMP. For example, the process could provide information to support hazard prediction and selected warning of affected units.

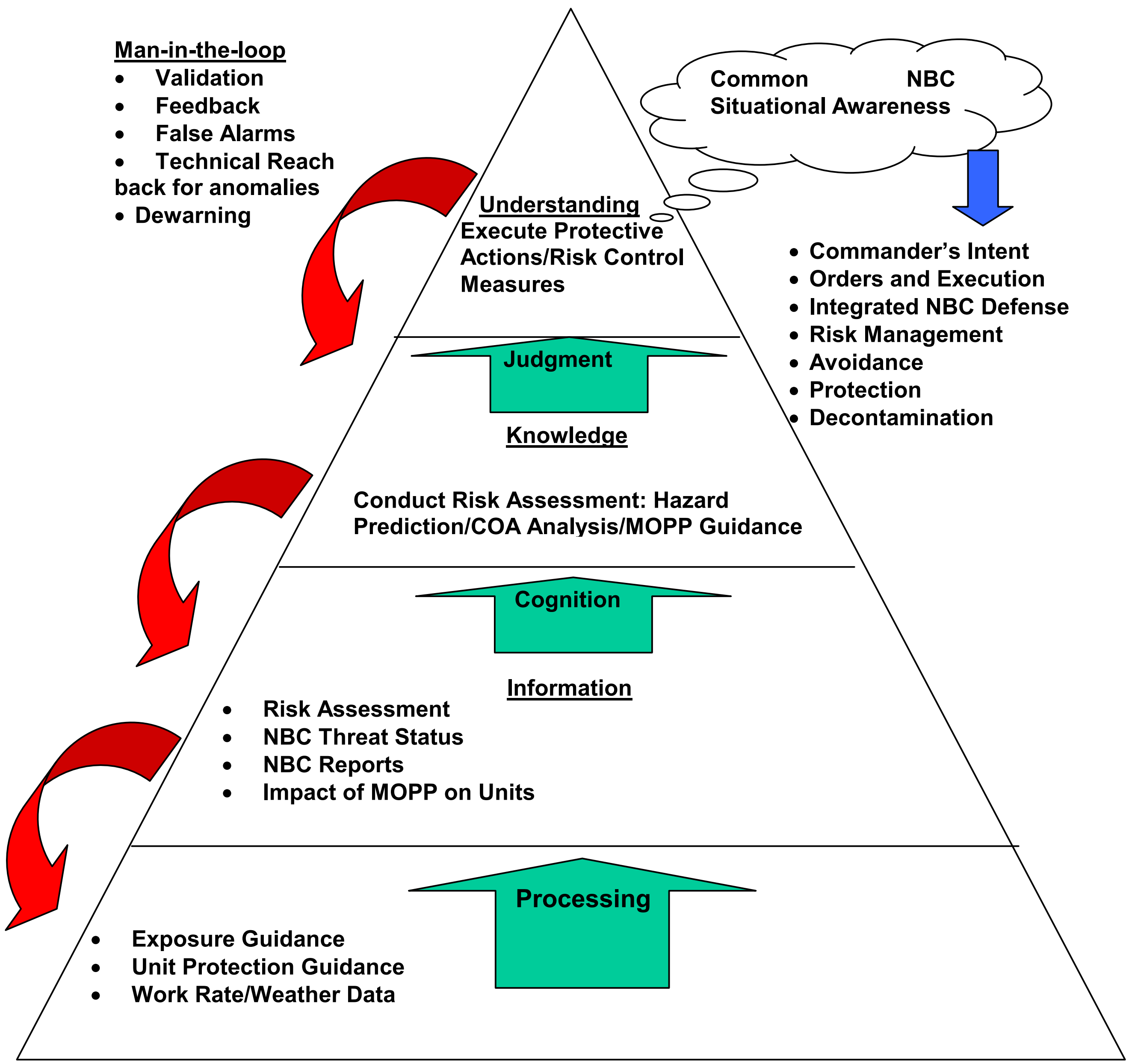


Figure I-2. NBC Information Management

5. NBC PROTECTION COMPONENTS

3. NBC protection is a command responsibility and the commander directs actions to ensure continued mission accomplishment. However, there are broad groups of activity that comprise protective measures. There are individual protection, reacting to attack, collective protection (COLPRO), and health service support.

a. Individual Protection. Individual protection includes actions (i.e., passive measures, assuming MOPP) taken by individuals to survive and continue the mission under NBC conditions.

(1) Background. The commander provides force protection guidance in orders/directives. The establishment of protection guidance provides unit personnel and mission essential civilian personnel with key information (i.e., individual protection guidance, training, equipment, etc.) to ensure they are prepared (see Chapter VI and Appendix A for information and descriptions of individual protection and individual protective equipment capabilities, respectively).

(2) Passive Measures. Passive protection measures are those actions taken regardless of the status of NBC warfare. Passive protection measures can include the following:

- Provide realistic, integrated training.
- Use camouflage, dispersal, and concealment.
- Ready Positions. Take actions to make them more resistant to the blast effects of conventional or nuclear munitions, to the heat and radiation of nuclear weapons, and to the contamination of radiological, chemical, and/or biological weapons.
- Ready Personnel. Under the threat of enemy NBC attacks, leaders must ensure protection and detection equipment is prepared and readily available.
- Remain Mobile. Units take actions such as placing equipment in buildings.
- Cover supplies and equipment (e.g., use NBC protective covers).

(3) Assuming Mission-Oriented Protective Posture. MOPP balances protection requirements and performance degradation with mission requirements. The commander has responsibility for providing guidance for levels of protection. The higher the MOPP level, the more protection it provides, but the more it degrades performance. The leader's MOPP decisions are based on factors such as the threat, temperature, work rate, and mission. (see Chapter V).

(a) MOPP Analysis. Leaders, generally at shipboard, air operating base, and brigade/battalion level, establish protection levels based on a risk analysis of their unit's particular situation. The risk analysis finds the balance between reducing the risk of casualties and accomplishing the mission. During MOPP analysis, the commander considers factors such as mission, NBC threat status, and overall environmental factors.

(b) Specialized Protective Requirements. Individual protective requirements during toxic industrial materials threat conditions, such as operations near damaged industrial resources, or other military operations other than war (MOOTW) situations may also require use of other standard protection levels such as the US Environmental Protection Agency Levels A-D (see applicable service references such as FM 3-11.21).

b. Reacting to Attack. Personnel take immediate action to reduce the impact of an NBC attack. Following an attack, the use of MOPP involves balancing force survivability and mission continuation. Commanders determine the risk they are willing to take depending on the mission that must be accomplished. They take poststrike actions to restore fighting power and prepare to continue the mission. Specific actions vary according to the type of attack. (see Chapter II).

c. Collective Protection. Collective NBC protection is that protection provided to a group of individuals in a NBC environment which permits relocation of individual NBC protection, and complements the individual protection provided by MOPP gear. COLPRO provides a toxic-free working environment for selected personnel. This environment may allow personnel to function more effectively while continuing to wear overgarments (as with the ventilated facepiece system). Alternatively, it may allow personnel to temporarily remove overgarments. When collective protection shelters are used to provide relief from wearing MOPP, commanders establish a system for rotation of personnel. (See Chapter VII and Appendix B for more information on COLPRO).

d. Health Service Support.

(1) NBC protection includes provisions for adequate health service support. Commanders are responsible for maintenance of the health of their commands to assure mission accomplishment in the event of NBC attacks. Planning and training include maintenance of the health of essential civilian workforce members supporting military operations, as well as integration of military capabilities with those of the local public health services, including those of the host nation for operations abroad.

(2) Preparations for operations in potential NBC environments include pre-exposure immunizations, pretreatments, prophylaxis, and medical barrier materials applicable to the entire force, including multinational, interagency, and civilian participants. Post-exposure measures require prior planning and include continuation of preventive measures. In contaminated environments, commanders take action to ensure continued health service support capabilities, including provision of support for decontamination and security from nonmedical resources.

Chapter II

NUCLEAR, BIOLOGICAL, AND CHEMICAL PROTECTION (Before, During, and After Attack)

4. This chapter addresses actions that can be taken before, during and after an NBC attack. Because operations in an NBC environment could also include TIM incidents, this chapter also addresses suggested protective actions that can be taken in response to a TIM event.

6. PREATTACK ACTIONS

a. Background. There are many common preattack actions that can be taken to prepare for operations in an NBC environment. These actions could include –

(1) Assess NBC Threat, Potential Risk, and Likelihood of Attack. Commanders must continuously monitor intelligence assessments, situation reports, and other related information to prepare themselves to make an informed decision on whether or not to implement NBC defense measures upon notification of an attack.

(2) Implement Coordinated NBC Defense Plan. Commanders should direct implementation of the coordinated NBC defense plans developed for their unit. The kinds of actions to be implemented include, but are not limited to, dispersing available detectors, distributing IPE, conducting training, etc.

(3) Prepare to Provide Primary Care for Unit Casualties. Unit commanders should have their personnel prepare contingency plans for first aid of unit casualties.

(4) Determine and Implement MOPP. Based on the situation, commanders should determine and implement the appropriate MOPP level and variation if appropriate. (Note: see chapter VI and appendix A for information on individual protection and IPE capabilities, respectively, and chapter V and appendix C for information on MOPP analysis and the impact of MOPP gear on personnel, respectively).

(5) Minimize Skin Exposure. Commanders should direct personnel to minimize skin exposure to protect against hazards. Although inhalation of agent is a concern, many

agents can enter the body by penetrating the skin, or through cuts, cracks, or abrasions in the skin.

(6) Continue Good Hygiene Sanitation Methods. Commanders should require that their personnel practice proper hygiene and sanitation methods at all times.

(7) Deploy and Activate Detectors. Each unit, as part of the NBC defense plan, should deploy available detectors.

(8) Designate and Prepare Shelters. The commander should direct and designate appropriate rest and relief shelters. Protection from weapons effects, such as liquid and vapor contamination, blast, shrapnel, and heat, should determine the suitability of buildings as shelters. (Note: see chapter VII and appendix B for information on collective protection and collective protection equipment, respectively).

(9) Watch for Attack Indicators. All personnel should be alert for signs of attack.

(10) Cover Unprotected Mission Essential Equipment. Commanders should direct units to cover mission essential equipment to prevent deposition of contamination on the equipment. This will reduce the need for decontamination and minimize the possibility of personnel contaminating themselves if they have to handle the equipment at a later time.

(11) Integrate Available Alarm and Warning Systems.

(a) Alarm System.

- Alarms and Detectors (Chemical/Radiological Capability). Chemical and radiological agent alarms/detectors represent another common critical element for effective defense. Without them, a unit cannot be alerted and cannot detect chemical or radiological contamination. Once chemical, nuclear, or radiological agents have been used, alarms/detectors must either already be in use or ready to be used. The alternative is to have the units take protective measures (i.e., donning protective gear). This equipment provides units with the capability to detect chemical and radiological agents.

- Alarms and Detectors (Biological Capability). The first signal that a unit has been exposed to a biological agent may occur through large numbers of personnel becoming sick. However, there are biological point detectors that are available (i.e., Portal Shield, USN Interim Biological Agent Detection System, USA Biological Integrated Detection System, etc.) for support of the air and land component, and the maritime component.

(b) Warning Signals (Land Force and Air Base). The basic types of warning signals for warning personnel of an attack are vocal, sound, visual, and audiovisual. Personnel should warn others, using one or a combination of these signals. Personnel give the alarm as soon as an attack or a hazard is detected, and use an alarm method that cannot be confused easily with normal combat signals or sounds. All who hear or see the alarm must repeat it swiftly throughout their; and supplement the warning with all available communications capability. (Note: see paragraph 12 for specific information on warning signals for airbase and/or fixed sites).

- Vocal. The spoken word (vocal alarm signal) is the first way of informing personnel of an NBC hazard or attack. The vocal alarm for any chemical or biological hazard or attack is the word gas. The person giving the alarm masks first and then shouts “gas” as loudly as possible. Everyone hearing this alarm immediately masks and then repeats the alarm. The vocal alarm for the arrival of radiological contamination in a unit, area is the word fallout. The first individual to detect the arrival of fallout will usually be a radiological monitor operating a radiacmeter at the unit command post (CP). When this radiacmeter records an increase in dose rate to 1 centigray per hour or higher, (or other service determined threshold), the monitor should immediately alert unit personnel.
- Sound. Sound signals reinforce the vocal alarm to warn of the imminent arrival or the presence of NBC hazards. Sound signals consist of a succession of short signals such as the rapid and continuous beating on

any metal object or any other that produces a loud noise. The warning could be furnished by a succession of short blasts on a vehicle horn or other suitable device, or an interrupted warbling siren sound and vocal alarms in situations in which the sound is lost because of battlefield noises or in which sound signals are not permitted.

- Visual. Standard hand-and-arm signal may be used for NBC hazards and consists of putting on the protective mask, extending both arms horizontally sideways with double fists facing up, and moving fists rapidly to one's head and back to the horizontal position.
- Visual/Audiovisual. If the automatic chemical agent alarms are in operation, detected agents will trigger a visual and auditory alarm unit. The person who sees or hears an alarm signal from the alarm unit immediately masks and augments this signal with the vocal signal. Communications personnel who hear the vocal signal immediately mask and relay the signal over the unit communications nets. Personnel reinforce this signal with other sounds or visual signals.

(c) Shipboard Alarms. The shipboard interior communications general announcing system is integrated with a system of alarm signals. The signals override the microphone control stations and are intended to notify the ship's crew of imminent danger. These alarms, in order of priority, are the Collision, Chemical, General and Flight Crash.

- General Alarm. The general alarm signal is sounded by the officer of the deck (OOD) to notify the crew of a battle condition, Some ships sound battle tations (material condition ZEBRA) by the use of bugle or boatswain pipe. Others simply pass the word, "Man your battle stations." All hands shall report to pre-assigned stations and set material condition ZEBRA.
- Chemical Alarm. The chemical alarm signal is sounded by the officer of the deck or damage control officer, or sounded automatically by the shipboard chemical agent point detection system on ships so when there has been an attack on or in the vicinity of the ship. All hands exercise protective measures to reduce exposure and injuries.

(12) Air base/ Fixed Site Warning Signals.

(a) Commanders use standardized warning signals to prepare airbases or fixed sites for attacks, warn of attacks in progress, initiate post-attack recovery actions, and return the installation to a normal wartime state of readiness. Table II-1 covers suggested warning signals and required actions for installations within the CONUS and in US territories. Table II-2 provides suggested warning signals and required actions for OCONUS bases subject to attack or conventional attack.

Table II-1. Standardized Alarm Signals for the US and It's Territories and Possessions

USAF STANDARDIZED ALARM SIGNALS
FOR THE UNITED STATES, ITS TERRITORIES & POSSESSIONS

WARNING OR CONDITION	SIGNAL	MEANING	REQUIRED ACTIONS
ATTACK WARNING	3-5 MINUTE WAVERING TONE ON SIREN OR OTHER DEVICES 3-5 MINUTE PERIOD OF SHORT BLASTS FROM HORNS/ WHISTLES OR OTHER DEVICES	ATTACK IS IMMINENT, IN PROGRESS OR ARRIVAL OF NUCLEAR FALLOUT IS IMMINENT	PROCEED IMMEDIATELY TO DESIGNATED SHELTER OR TAKE OTHER APPROPRIATE PROTECTIVE ACTIONS ∞ LISTEN FOR ADDITIONAL INSTRUCTIONS
PEACETIME EMERGENCY WARNING	3-5 MINUTE STEADY TONE ON SIREN OR LONG STEADY BLAST ON HORNS, WHISTLES, OR SIMILAR DEVICE	PEACETIME DISASTER THREAT EXISTS ∞ POTENTIAL OR CONFIRMED HAZARD TO PUBLIC HEALTH, SAFETY, OR PROPERTY	TUNE INTO LOCAL RADIO, TELEVISION, OR CABLE STATIONS FOR EMERGENCY INFORMATION ∞ LISTEN TO PUBLIC ADDRESS SYSTEMS FOR ADDITIONAL INSTRUCTIONS ∞ BE PREPARED TO EVACUATE, TAKE IMMEDIATE SHELTER OR OTHER APPROPRIATE PROTECTIVE ACTIONS
ALL CLEAR	DECLARED VERBALLY BY LOCAL OFFICIAL AGENCIES	EMERGENCY TERMINATED	RESUME NORMAL OPERATIONS OR INITIATE RECOVERY IF APPLICABLE

REMARKS: Local, off-base jurisdictions rely on the National Emergency Action Notification (EAN) network and the Emergency Alert System (EAS). List local procedures:

(b) Warning signals quickly communicate the commanders' intentions, direct personnel and units to take pre-planned, time-phased defense actions, or simply notify everyone to take cover. Signals used to initiate pre-planned actions, may be specific to one or more functional areas. Other actions, such as assuming pre-designated MOPP conditions or seeking protective cover or shelter, may apply to most of the base or fixed site population. Although warning signals are primarily designed to provide air, missile, artillery, and ground attack warning, they may be used to warn of covert attacks with chemical and biological weapons.

(c) Alarm Conditions.

- Commanders declare alarm conditions to initiate passive defense actions in wartime. Unless local or theater requirements dictate otherwise, bases or fixed sites use the warning signals and alarm conditions in Table II-2. Alarm conditions, combined with supplemental instructions through the chain of command, are the most effective way to establish a defensive posture. When NBC threats are present, the commander further directs MOPP levels and variations to provide the minimum level of protection for the current mission and situation.

- Warning signals are used that are compatible with host nation, local, or theater systems. The base or fixed site warning system must provide effective coverage for all areas. Warning signal are displayed as visual aids in all work centers and common use areas (such as billeting tents, post office, latrines, dining facilities, recreation areas, etc.). Transient and new personnel are briefed on warning signals and protective actions.

- Local Variations. Commanders are authorized wide latitude in determining warning signals. This information my include changes in alarm color codes or audible signals to accommodate theater or host nation requirements, or supplemental information to respond to specific weapons or threats. Standard warning signals should be used to the greatest extent possible. Regardless of the signals used, commanders are responsible for disseminating the warning signals information to all assigned, attached, and transient personnel to ensure they take the correct defensive actions in response to the base warning signals.

Table II-2 Standardized Alarm Signals for Areas Subject to NBC Attacks

ATTACK WARNING SIGNALS FOR AREAS SUBJECT TO NBC ATTACK			
ALARM CONDITION	PRIMARY SIGNALS	ATTACK THREAT	GENERAL ACTIONS
GREEN	ALARM GREEN GREEN FLAG	ATTACK IS NOT PROBABLE	• MOPP 0 or as directed[1,3] • Normal wartime operations • Resume operations • Continue recovery operations
YELLOW	ALARM YELLOW YELLOW FLAG	ATTACK IS PROBABLE IN LESS THAN 30 MINUTES	• MOPP 2 or as directed[1] • Protect and cover assets • Go to protective shelter or seek best protection with overhead cover
RED	ALARM RED ATTACK SIREN RED FLAG	ATTACK BY AIR OR MISSILE IS IMMINENT OR IN PROGRESS	• Seek immediate protection with overhead cover • MOPP 4 or as directed[1] • Report observed attacks

	ALARM RED GROUND ATTACK BUGLE CALL TO ARMS	ATTACK BY GROUND FORCE IS IMMINENT OR IN PROGRESS	▪ Take immediate cover,[3] ▪ MOPP as directed[1] ▪ Defend self and position ▪ Report activities
BLACK	ALARM BLACK STEADY SIREN BLACK FLAG	ATTACK IS OVER. POST-ATTACK ASSESSMENT NBC CONTAMINATION AND UNEXPLODED ORDNANCE HAZARDS ARE SUSPECTED OR PRESENT	▪ MOPP 4 or as directed[1,3] ▪ Perform self aid/buddy care ▪ Remain inside protective shelter or under cover until directed otherwise ▪ Begin post attack recon of outside areas when directed
[1] Wear helmet, flak vest, and web belt with canteen when outdoors, in unhardened facilities, or as directed. Commanders may direct continuation of mission-essential functions at increased risk. This alarm condition may be applied to an entire installation or assigned to one or more defense installations.			

(13) Warning Time Assessments. Commanders analyze the potential attack warning process to identify limitation and deficiencies. Warning times will vary by threat and the real-time ability of both theater and installation warning systems to disseminate warning information. Analyze the warning system performance for each primary threat (missile, aircraft, ground, etc.). Use the analysis to develop a chain-of-events timeline that identifies each primary and secondary warning event from initial event detection through notification to the lowest unit level. These timelines enable the chain-of-command to develop and practice pre-planned scenarios and quickly adjust strategies to react to attack situations. For example, installations may receive little (several minutes) or no warning of missile or artillery attacks. However, aircraft, cruise missile, and remotely piloted vehicle attack warning times (due to different flight profiles) may be long enough (tens of minutes) to allow extensive pre-planned actions. Regardless of the warning times, commanders and their staffs must quickly analyze the available attack information, evaluate the effect on current operations, and decide on the most effective courses of action within the time available.

7. NUCLEAR PROTECTION

5. This paragraph discusses aspects of nuclear protection that can be accomplished before, during, and after a nuclear attack. Personnel must make defensive preparations to protect themselves, and the effective use of terrain and shelter is also very important.
1. Terrain Use. By knowing how terrain affects nuclear weapons, personnel can greatly reduce the risk of becoming casualties. With training and practice, they can learn to recognize defensive positions that will give them optimum protection against a nuclear blast.
2. Hills and Mountains. Reverse slopes of hills and mountains give some nuclear protection. Heat and light from the fireball of a nuclear blast and the initial radiation tend to be absorbed by hills and mountains. What is not absorbed deflects above the personnel because of the slope.
3. Depressions and Obstructions. The use of gullies, ravines, ditches, natural depressions, fallen trees, and caves can reduce nuclear casualties (see Figure II-1.) However, predicting the actual point of an enemy attack of a nuclear weapon is almost impossible. A friendly strike provides more time to prepare. The best protection remains an area below ground with some sort of overhead cover.
4. Obscuration. When the threat of nuclear weapons use is high, smoke can be used to attenuate the thermal energy effects from nuclear detonations.

a. Actions Before An Attack (Note: see paragraph 1 for common preattack background).

(1) Background. The actions taken before an attack are critical because they will increase the unit's survivability to the greatest possible extent. These actions range from selecting the right shelters, fortifying those shelters, and protecting vital equipment, to using equipment to increase survivability. Whenever the tactical situation permits, units prepare defensive positions. These will vary from individual fighting positions to improved defensive positions. These actions and good prior planning protect against nuclear effects. Primary concern should be shielding from gamma and neutron radiation. Gamma radiation protection requires thick layers of dense or heavy shielding material. Examples are lead, iron, and stone. On the other hand, light, hydrogen-based material gives good neutron radiation protection. Examples are water, paraffin, and oil. These materials absorb

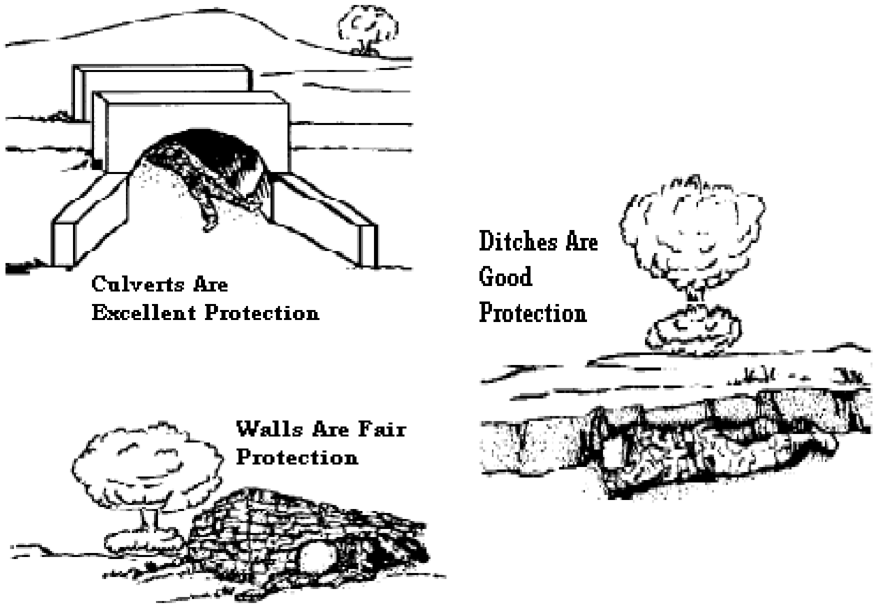


Figure II-1. Expedient Cover Against Blast and Thermal Effects

NOTE: The balance of the information in paragraphs 2-4 applies to land forces. See NWP 3-20.31 (Revision A), Shipboard Survivability, for TTP on maritime CBR defense measures.

NOTE: See Appendix D for more detailed information on radiological protection such as operational exposure guidance, low level radiation exposure, and depleted uranium.

(2) Fighting Positions.

(a) Digging in provides the best nuclear defense. This is because earth is a good shielding material. A well-constructed fighting position gives excellent protection against initial nuclear effects. It can also reduce residual radiation (fallout). Personnel must harden their fighting positions against the blast wave as time permits. Lining or revetting fighting positions can significantly increase survivability and decrease the size of the opening into the position. Smaller openings allow entry of less initial and residual radiation. However, many metal surfaces are good thermal reflectors. Cover these surfaces to prevent increased danger of burns from the heat of nuclear blasts. Figure II-2 shows examples of fighting positions that provide good protection.

(b) The smaller the fighting position opening, the better. Most of the gamma radiation in the bottom of a fighting position enters in through the opening. The smaller opening of a one-person fighting position reduces gamma radiation two to four times below the amount a two-person foxhole allows to enter.

(c) A deep fighting position gives more radiation protection than a shallow one. It places a greater thickness of shielding material or earth between the occupant and the nuclear detonation. Therefore, it provides greater reduction of initial radiation from entering. In a two-person fighting position, radiation reduces by a factor of two for each 16 inches of fighting position depth. Therefore, a fighting position at depth of 4 feet provides six to eight times the protection than a shallow one.

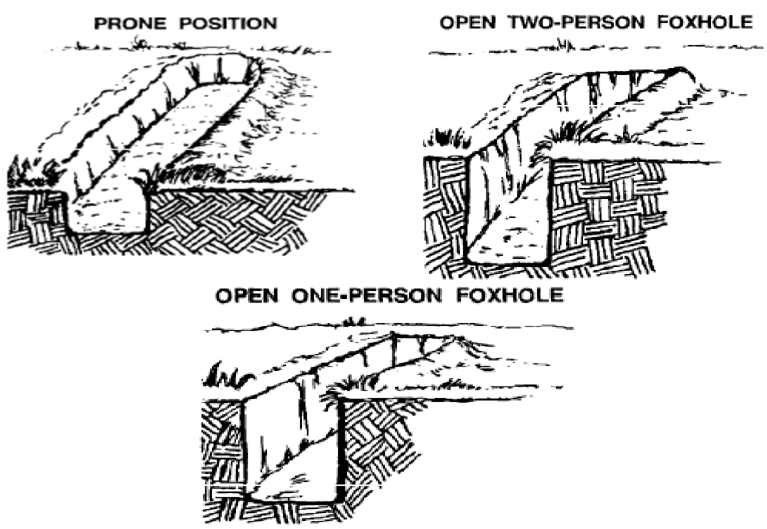


Figure II-2 Fighting Positions that provide good Nuclear Protection

(d) Thermal radiation can reach personnel in fighting positions by line-of-sight exposure or by reflection off the sides. Use dark rough materials to cover potential reflecting surfaces and as protective cover. Examples are wool (such as blankets) and canvas (such as shelter halves). Remember that thermal exposure may still burn or char these materials. Avoid direct contact with them. Do not use rubber or plastic materials alone. These items might melt and cause burns. Simply covering a position with ordinary metal screening material blocks the thermal radiation by about 50 percent. Use this screening for thermal protection without entirely blocking the view through the ports. Personnel must cover exposed portions, and they must keep low. Keeping low also reduces thermal exposure just as it reduces nuclear radiation exposure.

(3) Field-Expedient Overhead Cover.

(a) An overhead covering of earth or other material reduces exposure to thermal and initial nuclear radiation and fallout. Overhead covering helps prevent collapse. It also provides protection against debris such as falling rocks..

(b) Beware of poorly constructed overhead cover. The cover must be strong enough to withstand the blast wave. Figure II-3 shows some examples of good field-expedient overhead cover. Use U-shaped metal pickets, timbers, or certain fabrics, and overlay them with sandbags or earth. Ammunition boxes filled with earth also make good cover. In constructing effective overhead cover, remember the following:

5. Choose dense covering materials.
6. Cover in depth.
7. Provide strong supports.
8. Cover as much of the opening as possible.

(c) A vehicle provides expedient overhead cover. A simple and fast method is to drive a vehicle over the top of a foxhole (Figure II-4). A heavy armored vehicle is better than a wheeled vehicle. As with any type of overhead cover, initial radiation can still enter the fighting position through the earth sides or the openings in the sides of the vehicle (between treads, road wheels, and tires). If time allows, use sandbags to cover these openings. Remember, the vehicle is not a good neutron shield. Also, the blast wave may violently displace the vehicle and collapse a fighting position.

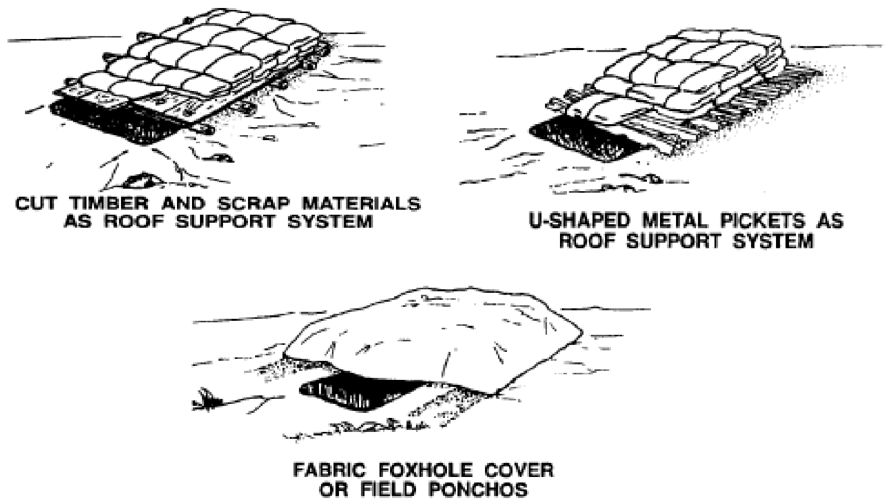


Figure II-3. Examples Of Field–Expedient Overhead Cover

Figure II-4. Tracked Vehicles as Expedient Overhead Cover

(4) Earth-Shielded Positions.

(a) Well-constructed fighting positions and bunkers can provide excellent protection against all effects of a nuclear detonation. Radiation is still an important concern, though, because of its great penetrating power. Radiation scatters in all directions after a burst.

(b) It is important that as much earth cover as possible be placed between the individual and the burst. The more earth cover, the better the shielding. Table II-3 illustrates the value of increasing amounts of earth shielding from a hypothetical free-in-air dose. An open fighting position gives a protection factor of eight. It blocks most of the line-of-sight radiation and allows only a fraction of scattered radiation to enter. Each added 6-inch thickness of overhead earth cover reduces the scattered radiation by a factor of two.

Table II-3. Shielding Values Of Each Cover For a 2,400-Centigray Free-In-Air Dose

PERSONNEL IN	RADIATION PROTECTION FACTOR	RESULTANT DOSE cGY
OPEN	NONE	2,400
OPEN FIGHTING POSITION 4" DEEP	8	300
OPEN FIGHTING POSITION 6" DEEP (Earth Cover)	12	200
OPEN FIGHTING POSITION 12" DEEP (Earth Cover)	24	100
OPEN FIGHTING POSITION 18" DEEP (Earth Cover)	48	50
OPEN FIGHTING POSITION 24" DEEP (Earth Cover)	96	25

(c) Flat earth cover of an underground shelter protects much better than an equivalent thickness of cover on a similar aboveground structure. This is because the underground line-of-sight thickness is greater. (See Figure II-5).

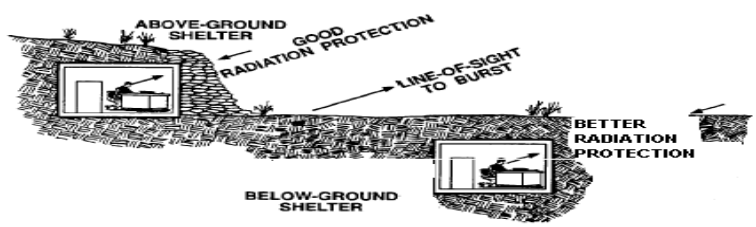


Figure II-5. Section View Of Shelters

(d) A second layer of sandbags gives more protection to fighting positions. Each layer of sandbags, if filled with sand or compacted clay, reduces the transmitted radiation by a factor of two. Table II-4 shows the payoff for adding layers of sandbags for a hypothetical free-in-air dose of 2,400 cGy.

(e) Sand or compacted clay gives better radiation shielding than earth because it is denser. Each layer of sand- or clay-filled sandbags can give up to 66 percent more radiation protection than the same thickness of soil or soil-filled sandbags. For example, Table II-3 shows that 12 inches of earth gives a protection factor of 24 (100 cGy) for a hypothetical 2,400 cGy dose, and Table II-43 shows that 12 inches (three layers) of sand-or-clay-filled sandbags gives a protection factor of 64 (38 cGy) for the same dose. Generally, heavier sandbags protect better than lighter ones.

(f) Neutron radiation can be stopped. Water delays and absorbs neutrons, but since some gamma radiation is given off in the process, dense shielding is still required. Damp earth or concrete protects from both forms of radiation. For example, only 12 inches of concrete or 24 inches of damp earth reduce neutron radiation exposure by a factor of 10. Wet sandbags achieve a reduction factor of two for every 4-inch layer. Other expedient neutron-shielding materials include containers of water, fuel, or oil. Remember that radiation scatters in all directions, and shielding must provide all-around protection.

Table II-4. Radiation Protection Factor Of Sand Or Clay-Filled Sandbags

PERSONNEL IN	RADIATION PROTECTION FACTOR	RESULTANT DOSE cGY
OPEN	NONE	2,400
OPEN FIGHTING POSITION 4’ DEEP	8	300
OPEN FIGHTING POSITION 4’ DEEP 1 Layer (4 inches)	16	150
OPEN FIGHTING POSITION 4’ DEEP 2 Layers (8 inches)	32	75
OPEN FIGHTING POSITION 18’ DEEP 3 Layers (12 inches)	64	38

(g) Protect sandbags from exposure to thermal radiation. Sandbags can burn and spill their contents, which can then be moved more easily by the blast wave. Cover sandbags with a small amount of earth and/or sod to eliminate this problem. Covering sandbags also enhances camouflage and provides valuable additional conventional fragmentation protection.

(5) Buildings.

(a) Certain types of buildings offer excellent shelter from nuclear hazards and require a minimum of time and effort to adapt for use. Choose buildings carefully. The stronger the structure, the better the protection against blast effects. The strongest are heavily framed buildings of steel and reinforced concrete. The worst choices are the shed-type industrial buildings with light frames and long beam span. Even well-constructed frame houses are stronger than the latter. Figure II-6 shows some examples of typical structures that provide good protection. Ammunition storage bunkers also give exceptional protection. These are usually large enough for most vehicles and equipment.

Figure II-6. Typical Structures That Provide Good Nuclear Protection

(b) Many European rural and urban structures can provide good protection. Many types of pre-World War II European buildings provide good blast and radiation protection. Examples are farmhouses, churches, and municipal buildings. Characteristics to look for include the following:

- Pre-World War II design and construction. These have thick, full-span floor and ceiling beams; heavy roofing tiles; dense, reinforced walls; and, in most cases, a full basement.
- Full basements constructed of concrete or stone. Make sure there is an exit directly to the outside as well as through the upper floors in case of emergency.

- Thick-walled, masonry structured. A thickness of 36 centimeters (greater than 1 foot) is an indication of good, pre-World War II wall construction. In areas, particularly southern Germany, where construction details are typically concealed by stucco finish, desirable features underneath are noticeable when the outside walls are wet.
- Buildings with the least amount of glass. European details are typically are protected by roll-up or folding shutters. These coverings provide some additional blast and thermal protection.

(c) A shielded building is best. Exterior rows of buildings in closely arranged groups (towns) shield buildings in the interior. These shielded structures suffer less blast overpressure and structural damage than exposed structures. However, debris and rubble problems and fire hazards may increase toward the center of town. Commanders should consider using shelters located two or three rows of buildings from the edge of town to avoid serious hindrance to postattack mobility.

(d) Personnel should get below ground level. The basement, because it is below ground, provides increased blast protection and much more line-of-sight radiation protection than above ground floors. This additional protection results from the surrounding earth fill. Add additional radiation protection by placing a layer of earth or sandbags on the floor above. This additional dead weight will be significant and may require shoring up the floor. Alternately, more protection can be gained by sandbagging a smaller shelter in the basement (such as a sturdy table) without increasing the possibility of the entire floor collapsing. Block windows with sandbags, and enhance the radiation protection and structural strength of any aboveground exterior walls by piling dirt and sandbags against the walls. Generally speaking, personnel can reduce radiation by a factor of 10 in basements as compared to levels in aboveground floors.

(e) Positions inside of the building can make a difference if sufficient time is available to properly prepare it. On floors above ground, the center of the building offers the greatest protection from both initial and residual radiation. Below the ground, the corners of the building give the greatest protection. In either case, the dose to prone personnel would be about one-half the dose to an individual standing. The lesson here is to seek shelter in an underground structure and lie in a corner. If an underground shelter is not available, lie in the center of a shelter under a sturdy table. Other options include lying inside a fireplace, under a stairway, or in a bathroom where the plumbing and relatively close spacing of walls might provide increased structural strength.

(6) Tents. Tents are not a preferred shelter against the effects of nuclear weapons. A tent does provide some protection from residual nuclear effects (i.e., particulate fallout).

(7) Armored Vehicles.

(a) Armored vehicles give good nuclear protection. In most situations, tanks provide the best vehicular protection available. Lightly armored vehicles also give good protection. These vehicles include infantry fighting vehicles, armored personnel carriers, self-propelled artillery, and some heavy engineer equipment. If time is available, this protection can be improved with any of the following actions.

(b) Get as low as possible inside an armored vehicle. Crew members normally elevated in a tank turret should get on the floor of the armored vehicle. This applies to the tank commander, gunner, and loader. Assuming such a low position reduces the radiation received by a factor of four.

(c) Keep all hatches shut. Obviously, an open hatch will expose the crew unnecessarily to explosion effects. It could also subsequently allow the entry of fallout particles and scattered gamma radiation. Close any other openings, such as the main gun breech.

(d) Prevent injury while inside an armored vehicle. The blast wave will throw soldiers violently about inside an armored vehicle. Wear combat vehicle crew (CVC) helmet or kevlar helmet with chinstrap secured to help prevent head injuries.

(e) Secure all loose equipment inside the vehicle. The force of the blast can throw about unsecured, loose equipment inside the vehicle, such as tools, weapons, and helmets, and cause injury or death.

(f) Dig in armored vehicles (hull defilade) or place them in trenches or cuts in roadways. This provides some limited line-of-sight radiation protection and considerable blast protection. A hull defilade fighting position or trench that allows half of the vehicle sides to be covered can reduce gamma radiation by as much as a factor of two.

(g) Use sandbags as radiation shielding. A single layer of sandbags placed on top of a tank turret or armored vehicle hull provides valuable overhead gamma shielding. Each layer of sandbags reduces the gamma radiation by a factor of two. Wetting the sandbags enhances the neutron radiation shielding and protects the sandbags from thermal damage.

(8) Wheeled Vehicles.

(a) Avoid using wheeled vehicles as shelter. Generally, wheeled vehicles provide little or no protection from the effects of nuclear explosions. Worse still, they are particularly vulnerable to overturning. This exposes drivers and passengers to increased risk. The percent of casualties from blast effects is dramatically greater for personnel in wheeled vehicles than for those in the open (see Table II-5). The percent of casualties expected from radiation is the same for both.

Table II-5. Comparison Of Blast Casualties From a 10-Kiloton Fission Weapon

RANGE (METERS)	200	300	400	700	800	900	1,000	1,400
Personnel in open (percenttage)	100	80	41	11	8	5	4	0
Personnel in wheeled	10	100	100	99	80	62	43	1

vehicles (percentage)								

(b) Personnel should protect themselves as much as possible inside vehicles.

(c) Secure all loose equipment inside the vehicles.

(d) Plan for and prepare adequate field shelters immediately adjacent to facilities that require personnel to continue operations in wheeled vehicles. Parking the vehicle inside or under a shelter gives some protection to personnel inside. Existing or natural structures such as ammunition bunkers, underpasses, tunnels, and caves, are in this category.

(9) Aircraft Ground Operations.

(a) Revetments give little protection against blast overpressure. However, revetments and barricades protect aircraft from damage by dynamic wind. These also protect aircraft from other hazards, such as the impact of rocks, sand, and other aircraft or aircraft debris. The tactical situation may require revetting for protection from conventional weapons blast and fragmentation damage. Use overhead cover for aircraft, if it is available. Close doors and windows against damaging overpressure.

(b) Tiedowns can reduce damage from tumbling of the aircraft. Generally, tiedowns do not produce excessive stress on tiedown points. Aircraft plexiglass windows shatter into fragments. This can happen at low blast overpressure (1.5 pounds per square inch) when there is no other significant damage. Tape the edges and the centers of windows. This reduces the extent of fragmentation and the nuisance fragments may cause to cockpit operations.

(10) Electromagnetic Equipment. Prior to an attack where enough warning has been given to the personnel, commanders must ensure that any electronic equipment such as radios and computers are turned off and protected. Electromagnetic pulse (EMP) is the high-energy, short duration pulse (similar in some respects to a bolt of lightning) generated

by nuclear detonation. It can induce a current in any electrical conductor and temporarily disrupt or overload and damage components of improperly protected or unprotected electronic equipment.

b. Actions During an Attack.

(1) Background. Nuclear attack indicators are unmistakable. The bright flash, enormous explosion, high winds, and mushroom-shaped cloud clearly indicate a nuclear attack. An enemy attack would normally come without warning. Initial actions must therefore be automatic and instinctive. Dropping immediately and covering exposed skin provide protection against blast and thermal effects.

(2) Immediate Actions.

(a) An attack occurring without warning is immediately noticeable. The first indications will be very intense light. Heat and initial radiation come with the light, and blast follows within seconds. Time to take protective action will be minimal. If exposed when a detonation occurs, personnel should do the following:

- Immediately drop facedown. A log, a large rock, or any depression in the earth's surface provides some protection.
- Close eyes.
- Protect exposed skin from heat by putting hands and arms under or near the body and keeping the helmet on.
- Remain facedown until the blast wave passes and debris stops falling.

(b) Stay calm, check for injury, check weapons and equipment damage, and prepare to continue the mission. Personnel in fighting positions can take additional precautions. The fighting position puts more earth between personnel and the potential source of radiation. They can curl up on one side, but the best position is on the back with knees drawn up to the chest. This position may seem more vulnerable, but arms and legs are more radiation-resistant and will protect the head and trunk. Store bulky equipment, such as packs or radios, in adjacent pits if they prevent personnel getting low in their positions, or place these items over the face and hands for additional radiation and blast protection.

(c) Personnel inside shelters should take protective actions. A blast wave can enter the shelter with great force, and the debris it carries can cause injuries. Lying facedown on the floor of the shelter offers protection. However, avoid the violent flow of air from doors or windows. Lying near a wall is safer than standing away from a wall. Near a wall, reflection may increase the pressure wave. Constructing baffles or turns in shelter entrances can prevent overpressure buildups and entry of dust and debris.

c. Actions After an Attack. Protection must not stop when the attack ends. Immediately after an attack, post attack recovery begins. Personnel must check for radioactive contamination, and then must reduce the hazard with basic decon. Decontamination techniques to reduce radioactive contamination are to brush, scrape, or flush radiological contamination from surfaces. As a minimum, unit personnel cover positions and shelters, and radiac operators begin continuous monitoring. Use of the IPE reduces the amount of contaminants that could enter the lungs, and the potential for skin burns from beta and alpha particles. For the commander, post strike actions include damage assessment and restoration of combat power.

d. Nuclear Casualties. Blast, thermal radiation, and nuclear radiation all cause nuclear casualties. Except for radiation casualties, treat nuclear casualties the same as conventional casualties. Wounds caused by blast are similar to other combat wounds. Thermal burns are treated as any other type of burn. First aid cannot help radiation casualties. These casualties will be referred to medical facilities.

8. BIOLOGICAL PROTECTION

6. This paragraph discusses aspects of protective actions that must be accomplished before, during, and after a biological attack. Protection against biological agents begins long before the actual attack happens. Biological agents can enter the body through the skin, respiratory tract and digestive tract. Key preparations begin with personal health maintenance followed by NBC defensive training, which all personnel must master.

a. Background.

(1) Biological agents can be classified according to their biological type, operational effects, and physiological action Operationally, biological agents are best thought of as either pathogens or toxins.

(2) Pathogens. Pathogens are living organisms. As such they require certain conditions of temperature, humidity, protection from sunlight, and a susceptible host population. The biological agent must overcome a host's natural defenses (during a latent period) in order to cause casualties. The duration period of this incubation could last from hours to days. Pathogens can be disseminated in either a wet or dry form. Additionally, some pathogens are contagious and can be spread from individual to individual; therefore, personnel not in the initial area of attack could become casualties. Following large-scale dissemination of a biological agent, an initial outbreak of disease of epidemic proportion might occur.

(3) Toxins. Toxins are poisons naturally produced through the activities of living organism. Toxins can be artificially synthesized (i.e., powder form) and disseminated in liquid or dry form. Toxins also generally do not cause immediate casualty producing effects, and casualties will arise in hours to days after exposure. Unlike pathogens, toxins do not cause contagion (i.e., ability for one person to infect another).

(4) Duration of effectiveness of a biological agent. The duration of effectiveness of a biological agent depends on the characteristics of the agent, environmental factors, and any residual hazards. Solar (ultra-violet) radiation, relative humidity, wind speed and

temperature gradient are the most important weather factors in determining duration of effectiveness. As previously mentioned, biological agents can be disseminated as aerosols, liquid droplets (toxins only), or dry powders. To a certain extent the state in which an agent normally exists determines its delivery state, use, duration of effectiveness, and physiological action.

(5) Cause of biological agent casualty producing effects. The primary cause of biological agent casualty producing effects is through inhalation of an aerosol's agent containing particles. Additionally, casualties can also be caused by the percutaneous effects of agents such as mycotoxins. Weather conditions have a tremendous impact on employment of biological agents. Biological agents will generally dissipate and decay in the presence of solar radiation. Some of the agent containing particles (disseminated in a dry form, i.e., spores) disseminated as an aerosol, may settle out of suspension onto the ground; however, the impact of any residual hazard from reaerosolization would likely be no more than a negligible risk.

(6) Protective Measures. Protective measures include use of individual protective equipment, good hygiene, proper sanitation, and keeping immunizations current. An individual's IPE provides protection against all biological warfare agents; however, based on the delayed casualty producing effects of biological agents, personnel will not likely know when they have been exposed. See service references such as FM 8-284 for information on treatment of biological agent casualties.

b. Actions Before an Attack. (Note: see paragraph 1 for common preattack actions).

(1) Preparations before an attack can be accomplished long before a biological attack happens. Personal health maintenance and realistic training are just a few ways in which the commander can minimize his biological casualties.

(2) Personnel Health Maintenance. All personnel and leaders must adhere to the basic principles of good health. This applies especially under NBC conditions. Personnel must continually follow these basic principles such as up-to-date immunizations, good hygiene, area sanitation, and physical conditioning.

(3) Up-to-date Immunizations. Immunizations reduce the chances of becoming biological casualties. Many diseases uncommon in the United States such as cholera and plague are prevalent in other parts of the world. Proper immunizations protect against many known disease-producing biological agents. All personnel receive basic immunizations. Medical personnel periodically screen these records and keep them up to date. If units deploy to areas in which specific diseases are prevalent, readiness preparation may include providing additional immunizations for needed protection. This prophylactic inoculation should be part of the intelligence preparation of the battlespace (IPB) process and needs to be brought to the commander's attention.

(4) Good Hygiene. Protect against the spread of disease by practicing good health habits. The best defense against biological agents is good personal hygiene, keeping the body as clean as possible. This means not only washing the face and hands but also all parts of the body, particularly the feet and exposed skin. Hands need to be cleaned before meals or anytime bare hands are used to help ingest food and liquid or when smoking. Shaving may seem unimportant in the field, but it is required to achieve a proper seal of the mask. This is important because biological agents and toxins are usually most effective when received via the respiratory system or the skin. Small nicks, scratches, and cuts are unavoidable in a field situation. Germs, either naturally occurring or intentionally employed as biological agents, enter these breaks in the skin and will cause infections if left untreated. Personnel should clean any breaks in skin with soap and water followed by first-aid treatment.

(5) Area Sanitation. Another way to stop the spread of disease is to keep the area clean. Bury all empty ration packets and residue. Locate, construct, and use field sanitation facilities properly. Latrine facilities should include soap and water for washing of hands. Latrines need to be cleaned daily. Avoid leaving such facilities open, and make sure they are properly filled and marked before moving, to help prevent accidental digging in the areas. Control of insects and rodents is also essential in preventing spread of disease. Additional information on field sanitation may be found in service preventive medicine publications.

(6) Physical Conditioning. Good physical condition requires maintaining the body in a well-rested, well-fed, healthy state. Personnel should get as much exercise and rest as the situation permits, and they must remember to eat properly. If they keep healthy, their bodies will be better able to fight off germs. A high level of physical fitness also reduces the likelihood of heat stress when MOPP gear is worn for extended periods. Continuous operations will require that personnel learn to sleep in short naps and in MOPP4. This is also part of the conditioning process. It may also become necessary to eat smaller portions at more frequent intervals.

(7) NBC Training. Training in an NBC environment is integrated into all areas of unit training: individual and collective. Personnel learn, practice, and train to perform individual NBC survival tasks. Leaders are directly responsible for reinforcing these tasks through continuous training, thereby instilling individual confidence.

c. Actions During an Attack. If threat forces attack with biological agents, there may be little or no warning. This will depend on IPB assessment. Units automatically mask when there are high probability indicators of an attack to protect them against contamination.

(1) Biological Attack Indicators. Biological agents may be disseminated as aerosols, liquid droplets or dry powder. Attacks with biological agents will be very subtle or direct if

favorable weather conditions prevail. Symptoms can appear from minutes to days after an attack has occurred. Indicators may include –

- Mysterious illness-many individuals sick for unknown reasons.
- Large numbers of insects or unusual insects.
- Large numbers of dead wild and domestic animals.
- Mass casualties with flu-like symptoms, fever, sore throats, skin rash, mental abnormalities, pneumonia, diarrheas, dysentery, hemorrhaging or jaundice.
- Artillery shells with less powerful explosions than HE rounds.
- Aerial bombs that pop rather than explode.
- Mist or fog sprayed by aircraft or aerosol generators.
- Unexploded bomblets found in the area.

(2) Immediate Actions. Putting on the protective mask and keeping the clothing buttoned up protects adequately against living biological agents. But, an agent can gain entry through openings such as button holes; zipped areas; stitching; poor sealing at ankles, wrist, neck; or through minute pores in the fabric of clothing. Toxins, however, require the same amount of protection as liquid chemical agents. Since no immediate-warning, biological agent detection device is fielded, consider any known agent cloud as a chemical attack, and take the same actions prescribed for a chemical attack. For collective protection, personnel must be housed inside a shelter with an efficient air filter system. Many buildings can be converted into temporary shelters if cracks are carefully sealed and a filter system with a ventilating mechanism is installed.

d. Actions After the Attack. Actions after a biological attack include beginning post attack recovery, and other actions such as taking samples and identifying a casualty by the symptoms they exhibit and treating those symptoms. Early recognition of symptoms and their treatment will increase recovery time and hopefully decrease fatalities.

(1) Agent Exposure. It is necessary to isolate individuals showing symptoms of disease. This isolation helps prevent possible spread to others if the disease is communicable. Treatment of biological agent casualties requires medical assistance as soon as possible. Further, symptoms associated with some toxins mimic other illness or chemical casualty symptoms. Toxin symptoms may include –

- Dizziness, mental confusion, or double or blurred vision.
- Skin tingling, numbness, paralysis, or convulsions.
- Formation of rashes or blisters.
- Coughing.
- Fever, aching muscles, and fatigue. *Difficulty in swallowing.
- Nausea, vomiting, and/or diarrhea.
- Bleeding from body openings or blood in urine, stool, or sputum (spit).
- Shock. These symptoms appear in minutes or hours after the toxin attack.
- Personnel should decontaminate immediately after a toxin attack. They should wash with soap and water.

(2) Unmasking Procedures. Unless prior warning is received from higher headquarters of the requirements to mask in advance of arrival of a biological aerosol attack, units will likely not be aware that they have been exposed to a biological agent. However, if a unit has received prior warning of an advancing aerosol cloud, there are procedures that can be implemented. For example, a biological agent point detector can indicate (through its' air monitoring capability) when an aerosol cloud has passed the point detector. Once that occurs, units use devices such as hand held assays to conduct testing to determine if positive test results are received. The report information is passed to the NBC center and the commander considers this data as well as data from other sources (i.e., weather, time of day, threat, etc). Based on the multiple sources of data, the commander considers whether to reduce protective levels.

9. CHEMICAL PROTECTION

7. This paragraph discusses aspects of protection that must be accomplished before, during, and after a chemical attack. Protection against chemical agents begins prior to an attack. Chemical agents can enter the body through the skin, eyes, and respiratory tract. Leaders conduct defensive planning against possible chemical agent attack. Units prepare SOPs that specify their chemical defense techniques and procedures.

a. Background.

(1) Chemical agents having military significance are categorized as nerve, blister, blood, incapacitating, or choking agents. These chemical agents maim, kill, seriously injure, or incapacitate unprotected personnel. Chemical agents are classified according to their physical state, physiological action, and use. The terms persistent and nonpersistent describe the time chemical agents remain in a targeted area.

(2) Chemical agents may exist as vapors, solids, or gases; and depending on the temperature can cause casualties as a vapor or solid. For example, an agent may be disseminated as a liquid casualty hazard from a delivery vehicle; and still remain a hazard as a vapor if the agent off-gases from a porous surface during high temperatures. To a certain extent, the state in which an agent exists determines its use, duration, effectiveness, and physiological action.

(3) Personnel can be exposed to chemical warfare agents through breathing (inhalation), the skin, and the eyes. Drink and food contaminated by CW agents are harmful. Other means of exposure are breaching of the full protective ensemble (i.e., from a tear caused by a munitions fragment) and /or transfer from a contaminated surface during processing through a contamination control area. The casualty-producing effects of chemical agents can occur within seconds, minutes, or hours. For example, nerve agents are quick acting and can cause casualty-producing effects within minutes. Alternatively, blister agent casualty producing effects can take hours for them to cause their results.

(4) Additionally, chemical warfare agents in liquid form can soak into material such as painted surfaces, wood, concrete, or soil making evaporation slower than non-porous surfaces. Personnel could potentially come into contact with casualty producing liquid agent prior to the agent absorbing into the porous surface. Alternatively, once a liquid agent absorbs into a porous surface such as concrete (e.g., during cool evening temperatures), the agent may off-gas as a vapor during higher daytime temperatures and also cause chemical agent symptoms among exposed personnel. Further, there are other possible situations wherein casualty-producing effects of chemical agents can be impacted by temperature and type of surface (i.e., during cold weather, chemical agent vapor is absorbed by an individual's protective clothing; the agent off-gases during the persons entry into a shelter for warming, and the individual suffers chemical agent signs and symptoms).

(5) Solid and liquid agents may persist for hours, days, or months depending on the agent, weather conditions, and other factors.

b. Pre-Attack Actions. (Note: see paragraph 1 for information on common preattack actions).

(1) Assess chemical threat, potential risk, and likelihood of attack.

(2) Implement coordinated chemical defense plan.

(3) Prepare to provide primary care for unit casualties.

(4) Determine and implement MOPP.

(5) Minimize skin exposure.

(6) Continue good hygiene sanitation methods.

(7) Deploy and activate detectors.

(8) Designate and prepare shelters.

(9) Watch for attack indicators.

(10) Cover unprotected mission essential equipment.

c. Attack Actions.

(1) Attack Warnings. Detection and warning of the attack are critical to the implementation of protective measures. The attack warning signal, directs personnel to take cover and use protective measures.

(2) Take Cover. Taking cover protects personnel against blast, shrapnel, heat, and liquid and particulate contamination. After taking cover, personnel don their masks and remaining protective gear as appropriate.

(3) Use MOPP 4. All personnel should assume MOPP 4 (full IPE) in the absence of any other information, and remain in MOPP IPE until directed to reduce their MOPP level.

d. Post-Attack Actions. (Begin post attack recovery).

(1) Avoid Potentially Contaminated Surfaces/Areas. All personnel should minimize contact with potentially contaminated surfaces until there are indications that surface contamination is no longer a hazard.

(2) Obtain and Report Observations or Evidence of Attack. Personnel provide reconnaissance and assessment information for all types of damage and hazards.

(3) Survey, Control, and Mitigate Health Hazards (Treat and Evaluate Casualties). Health service support provides treatment for casualties according to established medical protocols.

(4) Adjust MOPP. Commanders should adjust the MOPP to the lowest possible level consistent with identified hazards.

(5) Document Exposure. Medical staffs should clearly document exposure in the medical records of those personnel who have been exposed.

(6) Sample, Monitor, and Analyze for Residual Hazard. Once the situation permits, the detection efforts determine the extent of the residual hazards.

(7) Plan and Implement Decontamination and Contamination Containment Actions. These actions are planned and implemented to minimize operational impacts of contamination.

(8) Unmasking Procedures (All Clear). Commanders should revert to an appropriate MOPP level based on the current threat in conjunction with the "All Clear" signal. Personnel engaged in passive defense functions should repair and resupply defense equipment in preparation for follow-on attacks. All personnel should return their IPE to a ready status in anticipation of the next attack warning.

(a) Unmasking procedures should be conducted after all available methods of agent detection have failed to indicate any agent. Unmasking should be conducted as soon as possible to alleviate personnel encapsulation as quickly as possible. The following two unmasking procedures will determine if unmasking is safe for chemical agents.

(b) Unmasking Procedures Using the M256-Series Chemical Detector Kit. The M256-series chemical detector kits do not detect all agents. Therefore, consider also using unmasking procedure listed in paragraph (c) below, even if the detector is available. These procedures take approximately 15 minutes. After all tests with the kit, including a check for liquid contamination, have been performed and the results are negative, the senior person should select one or two personnel to start the unmasking procedures. If possible, move to a shady place. Bright, direct sunlight can cause pupils in the eyes to constrict, giving false signs of nerve agent exposure. The selected personnel unmask for five minutes, reseal, and clear their masks. Observe them for ten minutes. If no symptoms appear, the commander/leader considers issuing the all clear signal for unmasking. Continue to watch the personnel for possible delayed symptoms. Always have first-aid treatment immediately available in case it is needed.

(c) Unmasking Procedures Without the M256 series Chemical Detector Kits. If an M256-series kit is not available, the unmasking procedures take approximately 35 minutes. Find a shady area. Use M8/M9 paper to check the area for possible liquid contamination. When a reasonable amount of time has passed after the attack, the senior person should select one or two personnel. The personnel take a deep breath, hold it, and break the seal for 15 seconds with eyes wide open. The persons then clear and reseal their mask, and are observed for 10 minutes. If no symptoms appear the selected personnel break the seal of their mask, take two to three breaths (keeping their eyes wide open), and clear and reseal their masks. Observe them for ten minutes. If no symptoms appear, the selected personnel unmask for five minutes and then remask. If no symptoms appear in ten minutes after remasking, the commander considers issuing a directive for an all clear. This process takes approximately 30-35 minutes. Leaders continue to observe the selected personnel in case delayed symptoms develop.

(d) Personnel Display Symptoms. In both cases, if personnel display symptoms of agent poisoning, ensure first-aid treatment is available and provided. If agent is still present, the senior person present must make a decision of selecting one of these options:

- Move to a new area and retest.
- If mission dictates that movement cannot be conducted, a retest can be conducted after one hour 30-60 minutes.
- Use collective-protection equipment, if available.

(9) Filter Exchange.

(a) Background. Filter exchange is another action that is based on design, physical condition, climatic conditions, and the possible threat agent that could be employed. Information in the following paragraphs addresses peacetime, transition-to-war, and wartime exchange criteria (Note: The information in this section is not met to supersede other guidance contained in service specific TTP or technical publications).

(b) Peacetime Filter Exchange. When assessing filter exchange criteria, several factors must be considered. Commanders and NBC personnel must monitor replacement schedules for pieces of NBC equipment having filters. Peacetime exchange criteria for all filters is one year or when the following conditions are applicable:

- Physical damage occurs.
- Filters have become water logged/wet.
- High resistance to airflow is observed.
- Directed by higher headquarters.
- Listed as unserviceable in applicable supply bulletin, technical order, etc.

(c) Transition to War Filter Exchange. Commanders will determine when their units should remove their training filters and replace them with filters from unit contingency stocks. This guidance should be reflected in an SOP or order. Factors for filter exchange consideration are: unit location, unit readiness/deployability alert status, last filter exchange, threat, time available, and stocks available. For example, a forward deployed unit commander, based on an enemy chemical capability in the area of operation, directs by SOP that his unit install its' contingency filter set. Alternatively, a CONUS based unit commander determines that the basis for installing contingency filters would occur upon an increase in unit alert status for deployment to an area with an NBC threat. Before initiating filter exchange, leaders consider the implications for their units. Some considerations are:

- Mission - What is the unit mission?
- Enemy - What is the current NBC threat assessment; is the unit likely to be attacked on arrival in the operational area?
- Terrain - Where should filters be exchanged? At home station, enroute, or in the operational area?

- Time - When should filters be exchanged When will there be adequate time to exchange filters?
- Personnel Available - Do we have the right people available to conduct the exchange?
- Civilian – Do mission essential civilians (contract and government) have appropriate IPE.

(d) Filter Exchange During Wartime. The decision to change filters is driven by two considerations: the amount of chemical agent the filter has been exposed to, and the time the filter has been exposed to the atmosphere. These separate considerations are based on the two mechanisms by which the filter provides protection from chemical agents. For all agents, the filter uses mechanical filtration and absorption as the protection mechanism. For blood agent CK, the filter uses a chemical reaction. The chemical reaction mechanism is degraded by prolonged exposure to CK and the absorption capacity, by exposure over time to air, particularly hot humid air (see Figure II-8). Based on these factors, the following filter change criteria applies:

- In an area of operation with no chemical attacks confirmed and no CK threat, change filters annually.
- In an area of operation with no chemical attacks confirmed and a CK threat, change the filters according to Table II-6. (Note: information in this figure is applicable to USA units; other services follow directives as prescribed in applicable technical orders and technical manuals).
- Physical damage occurs.
- Filters have become water logged/wet.
- High resistance to airflow observed.
- When directed by higher authority.
- For units that have received chemical attacks, change all filters every 30 days.

Table II-6. Wartime Climatic Filter Exchange Intervals, Blood Agent Threat Is High (Given In Weeks)

WARTIME CLIMATIC FILTER EXCHANGE INTERVALS BLOOD AGENT THREAT IS HIGH (GIVEN IN WEEKS)					
	CLIMATE CATEGORY				
FILTER	**COLD HUMID**	**WARM MODERATE**	**HOT DRY**	**HOT HUMID**	**SYSTEM**
C-2/M13A2	52	52	39	10	M40IM42/M43IM17-Series protective mask.
M10A1	52	52	52	13	M24/M25 protective mask.
M18 Gas	52	39	26	4	Filter comp of M13 tank GPFU.
M12A1 Gas	52	39	26	4	Fixed site filter used in structure and building.
M48 Gas/Particulate	52	52	39	10	M1A1 Tank overpressure system.
MCPE Gas/Particulate	52	39	26	4	Modular collective-protection equipment (MCPE).
HSFC Gas/Particulate	52	39	26	4	Simplified-protection equipment M20IM28.
M23 Gas	52	39	26	4	M51 Shelter.
M10 Gas	52	39	26	4	Fixed-site shelter.
C-22 R1 Gas	52	52	52	13	GPFU M46 fixed-site filter.

CLIMATIC DEFINITIONS		
CATEGORY	MEAN TEMP (F)	MEAN RELATIVE HUMIDITY (%)
Cold Humid	<-15	< 90
Warm Moderate	< 80	< 70
Hot Dry	< 98	< 27
Hot Humid	> 96	> 76

10. COLLECTIVE PROTECTION OPERATIONS

8. COLPRO does not replace MOPP gear nor the MOPP TTP. For example, the ventilated-facepiece system enhances MOPP gear protection. Overpressure systems create an artificial environment. This changes the nature of the NBC threat and allows the commander to order lower MOPP levels. Commanders and personnel should be familiar with several actions before, during and after an NBC attack to make the use of available collective-protection systems more efficient and effective.

a. Fixed Site Operations: (Before Attack).

(1) Before an NBC attack occurs, several actions should make the use of collective protection easier. Commanders should –

- Determine appropriate MOPP levels.
- Accomplish collective-protection planning.
- Ensure personnel are accounted for and briefed on the threat situation.

(2) Individual personnel should –

- Assume the appropriate MOPP level.

- Check protection system for proper operation.
- Know entry and exit procedures.
- Accomplish individual protective actions.

(3) The shelter attendants should –

- Inspect and maintain the shelter filter system.
- Inspect and maintain the communication system.
- Know entry and exit procedures.

b. Fixed Site Operations: Actions During an Attack.

(1) Actions that should be taken include suspending or minimizing entry into the shelter.

(2) The shelter attendants should –

- Don mask and alert shelter occupants.
- Aid in securing air lock doors.
- Prevent unauthorized personnel from entering the shelter
- Test periodically for contamination. If entry from a contaminated environment is mission essential, internal monitoring becomes critical.
- Ensure adherence to prescribed entry and exit procedures.
- Monitor the shelter interior every 15 minutes using detector/monitoring equipment.
- Suspend shelter operations if hazardous level of agent are detected inside. Personnel should assume the appropriate MOPP level and evacuate the shelter.
- Proceed with unmasking procedures when detector/monitoring equipment no longer indicates the presence of agents.
- Further actions during an attack will depend on the type of collective protection.

c. Fixed Site Operations: (Actions After an Attack).

(1) Vapor and liquid contamination hazard may remain for some time after an attack. Once it is determined that a hazard no longer exists, contaminated personnel conduct decontamination Personnel also take the following additional actions:

- Ensure contaminated items are not stowed in CPE.
- Acquire decon support if required.

- Resupply expendables, such as IPE, mask and shelter filters, and individual decon kits.
- Continue entry and exit procedures until one hour after detectors indicate the absence of agent vapors outside the shelter.
- Resume before-attack actions, but continue periodic monitoring of shelter interior with detector/monitoring equipment.

(2) After an attack, the shelter attendant will –

- Pass the all clear signal to the shelter occupants when safe to do so.
- Service the filter system if needed.
- Assist entry and exit procedures.
- Continue attendant duties.

11. TOXIC INDUSTRIAL MATERIALS (TIM) PROTECTION

a. Background. US forces frequently operate in environments in which there are toxic materials, particularly toxic industrial chemicals (TIC). A number of these chemicals could interfere in a significant manner across the range of military operations. Release of TIC is most dangerous at night because typical nighttime weather conditions produce high concentrations that remain close to the ground for extended distances. TIM can have other significant hazards. TIC are often corrosive and can damage eyes, skin, respiratory tract, and equipment, especially electronic equipment. Many TIM are flammable, explosive, or react violently with air or water. TIM can have both short-term and long-term health effects, ranging from short-term transient effects to long-term disability, to rapid death. Military protection, detection, and medical countermeasures are not specifically designed for the hazards from TIMs. Often there are no specific antidotes for TIMs (Note: see appendix E for information on the assessment of protective mask filter performance against selected TICs).

b. Actions Prior to an Incident/Accident.

(1) General Planning. Before any operation, the response element develops an understanding of the potential hazard from TIM in the area of concern. Further, information collection requirements that can support vulnerability analysis and assessment during the planning process (deliberate or crisis action) include some of the following key factors:

- Identifying all possible industrial plants, storage sites, and shipment depots.
- Identifying TIM routinely produced, used, or processed in the area.
- Assessing the effects of the release of TIM either as a result of collateral damage or accident.
- Assessing whether the deliberate release of a TIM is realistic in this particular situation.
- Identifying local hazard management procedures and civilian agencies responsible for handling HAZMAT incidents.
- Identifying local hazard identification labeling and placarding systems.
- Assessing the need for special detectors and modifications of detectors.
- Assessing the need for specialized protection equipment, such as self-contained breathing apparatus (SCBA) or special, impermeable chemical suits.

(2) TIM Evacuation Planning. When time and mission allow, evacuation is the best protective response to a TIM hazard. Plan evacuation of personnel closest to the hazard and outdoors, those in direct view of the scene first. Plan for in place protection when evacuation may cause greater risk than remaining in place. Inplace protection may not be an option if the TIM vapors are flammable, the hazard is persistent, or buildings cannot be closed tightly.

(3) Risk Assessment. Selected measures that support risk assessment include securing key information, assessing risk, and conducting NBC defense actions.

(a) Each situation has special problems and considerations. During planning, attempt to secure pertinent information involving production, storage facilities, distribution, and transportation of TIM. As a minimum, obtain the type, quantity, and specific risk from fire, explosion, toxicity, corrosive effects, and/or persistency of gas. Sources for this information include unit, intelligence personnel, appropriate scientific, civilian industrial, chemical warfare treaty experts, safety reports, and materiel safety data sheets (MSDS) on the facility, international code markings on storage tanks, and local civilian authorities who have emergency response procedures and resources.

(b) A thorough vulnerability analysis provides an initial estimate of the threat and is the first step toward mitigating the operational effects of damage or destruction of a TIM facility. Determining the TIM hazard/threat and possible counter measures in an area of operations is a primary responsibility of the medical and supporting preventive medicine staff. They are supported by the NBC and civil affairs staffs.

(c) Military protection and decontamination equipment was not designed for handling toxic industrial chemicals. For proper handling, protection, and hazard management information, units seek guidance from their C^2 element. Other sources for assistance include the CHEMTREC Hotline, for emergency assistance: within US/Canada: 1-800-424-9300 or Outside Continental US: 1-202-483-7617 (toll free if necessary). Commanders also identify the local civilian authorities that may have additional emergency response procedures and resources, which can be used.

(d) Some plants, facilities, storage containers, or transport containers may be identified by markers. These could take the form of international HAZCHEM markers that are diamond shaped and contain information that can be used to identify the exact industrial TIM. When encountering a suspect industrial chemical, attempt to identify the exact TIM and all possible information materials responders.

(e) For fire fighting, entering any enclosed space where there has been a TIMs or spill clean-up work, a self contained breathing apparatus (SCBA) must be used. The individual protective mask (NBC mask), does not afford sufficient protection within the immediate hazard zone where extremely high concentrations of industrial chemicals such as ammonia may occur and where the lack of oxygen requires the use for SCBA. The military respirator should only be used for emergency protection against the immediate effects of a toxic release and while evacuating from the immediate hazard zone. Further, military chemical protective suits (MOPP gear) are not designed for providing protection against TICs.

(f) The most important action in case of massive industrial chemical release is immediate evacuation outside the hazard's path. The greatest risk from a large-scale toxic chemical release occurs when personnel are unable to escape the immediate area and are overcome by vapors or blast effects. Military respirators and protective clothing may provide only limited protection against TIC. For detailed information on these TIC hazards, see: National Institute for Occupational Safety and Health, *Pocket Guide to Chemical Hazards*, and/or US Department of Transportation, *North American Emergency Response Guidebook*.

(g) In planning for operations in areas in which there may be toxic materials including TIM, the combatant and subordinate commanders include consideration of these potential hazards as part of the IPB process. These hazards could occur from massive deliberate or accidental release from industrial sites as well as storage and transport containers. Particular emphasis should be placed on those TIM that produce acute effects when inhaled.

c. Attack Actions.

(1) Unit Actions (Toxic Industrial Chemical or Biological Materials). Actions can include alerting higher, adjacent, and subordinate units; and –

- Starting monitoring, with the M256A1 Kit or similar detection devices. Ensure results are reported.
- Assuming MOPP 4, and move to a safe distance.
- Establishing security zone around the area.
- Evacuating casualties. Casualties should be considered as contaminated and should be contained in one central location. Initiate emergency decon of personnel.
- Identifying witnesses for questioning.
- Establishing a downwind hazard zone.

(2) Unit/Source Level Actions (Toxic Industrial Radiological Materials). Actions could include –

- Taking protective action.
- Assessing casualties and damage.
- Identifying potential location of the toxic industrial radiological materials.
- Beginning continuous monitoring, and reporting the arrival of fallout.
- Protecting from the effects of fallout and fires that may be started.
- Reporting increasing, decreasing, or peak dose rates. Report the completion of fallout.
- Receiving from higher headquarters an NBC 2 nuclear report. Preparing a simplified fallout prediction, and informing the commander.

d. Post Incident/Accident Actions. Key actions following an incident/accident can include –

- Control the situation.
- Self-protection.
- Prevent the situation from claiming more casualties.
- Rescue, protection, and treatment of victims.
- Decontaminate exposed victims and minimize the spread of contamination.
- Conduct early hazard identification.
- Preserve evidence per local SOP.
- Follow emergency response SOPs/OPLANs.
- Conduct coordination interaction with local, state, federal, and HN agencies as required.

(1) Self-protection. Is the key to successful response efforts. When personnel ensure their self-protection, they can save lives, minimize the spread of contamination, and protect property.

(2) Subsequently, units would likely isolate the area and deny entry except for authorized and protected personnel.

(3) Personnel remember that a TIM incident could be a crime scene. As a potential crime scene it is very important to preserve evidence to prosecute the individual or individuals responsible for the act.

Chapter III
OPERATION IN UNIQUE ENVIRONMENTS

Weather and terrain and how they affect the need for NBC protection must receive special consideration. Certain weather conditions will greatly influence the use of NBC weapons. Likewise, different types of terrain will alter the effects of NBC weapons. Also, the type of operation can directly bear on the need for NBC protection. This chapter addresses cold weather, desert, jungle, mountain, urban, and littoral operations, respectively.

12. COLD WEATHER TERRAIN

9. Cold weather environments create unique and diverse conditions which must be overcome to accomplish an assigned mission in an NBC environment.
   a. Nuclear Defense.

(1) General. The winter environment influences the effects of a nuclear detonation with regard to blast, thermal effect, and radiation effects.

(2) Blast Effects. At subzero temperatures, the radius of damage to material targets can increase as much as 20 percent. Tundra, irregular terrain features, and broken ice caps will break up the pressure wave and thereby reduce the effects of this powerful wave. Blast waves can drastically interfere with movement by breaking up ice covers and causing thaws with possible avalanches in mountainous areas.

(3) Thermal Effects. Ice and snow have a high reflectivity. This may increase the minimum safe distance as much as 50 percent for unwarned personnel. This reflectivity may increase the number of personnel whose vision is affected by the brilliant flash or light dazzle, especially at night. Cold temperatures reduce thermal effects on materials by reducing the possible heat signature. Snow, ice, and even frost coverings on combustible materials greatly reduce the tendency of materials to catch fire. However, this thermal effect will dry out exposed tundra areas and grass fires may result.

(4) Radiation Effects. The number of passable roadways is limited already by weather conditions, and radiological contamination on roadways may further restrict resupply and mobility. Seasonal high winds in the arctic may present a problem in radiological contamination predictions and crossing of contaminated areas.

b. Individual Protective Measures.

(1) At low temperatures, land forces operating in a field environment are particularly vulnerable to the effects produced by a nuclear detonation because of the difficulty in preparing fighting positions and underground fortifications for protection. Shelters and fortifications constructed from snow and ice provide some protection and wherever possible, should be constructed to take maximum advantage of the additional protection provided by natural terrain features.

(2) Snow and ice, although not as effective as earth in reducing radiation hazards is readily available and can be used to provide shielding against radiation effects. Loose snow falling on a contaminated area will have a half-thickness of about 60 centimeters (24 inches); and 30 centimeters (12 inches) of hard-packed snow will reduce the original value to ½ of its original value. Half-thickness is the thickness of material required to reduce the original radiation level (reading) to half its value.

(3) Cold weather clothing (outer shell, white) provides an advantage of low absorption properties and thereby reduces the thermal effects.

c. Monitor and Survey Operations.

(1) High winds will extend contamination zones creating a problem for monitor and survey operations. Aerial survey is a practical method in extreme cold weather areas dependent on operating altitude and environmental conditions.

(2) Hot spots or areas of concentrated accumulation of radiological contamination may occur in areas of heavy snow and snow drifts. These areas need special attention during survey operations.

(3) Radiac instruments (used to detect, survey and monitor radiological hazards) should be kept warm until use to ensure maximum efficiency. Refer to the appropriate technical reference for operating radiac systems in cold weather environments.

d. Decontamination Operations. Decontaminate radioactive fallout on vehicles via brushing using brooms, or even tree branches, due to the freezing point of water (32 Deg F). Radioactive effects (fallout) are being removed from items, not neutralized, which equates to transfer of contamination.

e. Biological Defense Considerations.

(1) General. Biological warfare in the arctic is a possibility and biological agents are effective in cold weather environments with few exceptions. Most vectors (infected insects) will not survive the extreme environmental conditions and it is more difficult to aerosolize live biological agents in freezing temperatures. Toxins, on the other hand, are less susceptible to the cold. At these temperatures spore-forming bacteria and certain viruses survive, remain dormant within cold and upon warming become an active hazard to personnel. Temperature inversions that exist over snowfields tend to prolong the integrity

of an aerosolized biological cloud. It would thus disperse more slowly and thus remain a threat for a longer period.

(2) Individual Protective Measures. Personnel are more susceptible to biological agents in arctic environments, mainly due to the rapid rate that diseases can spread in the crowded warming areas and the difficulty in maintaining an adequate intake of food (calorie intake increase, due to extreme physical demand), water, rest, and cleanliness.

f. Chemical Defense Considerations.

(1) General. In arctic conditions chemical agents act differently because of their different physical properties.

(2) Blister Agents. Some forms of blister agent are ineffective as casualty producers, because the ambient temperature could be well below their normal freezing points. This is not true for all blister agents, which can be effective as harassing or casualty producing agents.

(3) Nerve Agents. Significant contamination at low temperatures and wind speeds may remain several days. In severely cold conditions, nerve agents will remain liquid, which can be absorbed through normal cold weather clothing.

(4) Blood and Choking Agents. Blood and choking agents remain extremely hazardous and nonpersistent throughout the low temperature range. Table III-1 provides information on select chemical agents under cold temperature conditions.

Table III-1. Chemicals Agent Freezing Points

AGENT	FREEZING POINT
H, HD Mustard	14.5°C (42.3°F)
HT Mustard	0.0 to 1.3°C (32°F)
L	NA
GA	-50°C

GB	-56°C
GD	NA
GF	-30°C
VX	-30°C (-38°F)

g. Individual Protective Measures.

(1) General. With addition of chemical protective clothing, the cold weather-clothing ensemble increases the risk of heat casualties and degrades unit performance. Leaders will need to capitalize on MOPP analysis, risk assessment, and METT-TC in order to determine the recommended protection requirements.

(2) Protective masks. Always refer to the appropriate technical references for the IPE to obtain the proper procedures for wearing of the IPE during operations in cold weather environments. The following guidance provides quick tips for leaders to use as a guide when assisting their personnel before, during, and after operations in cold weather environments during NBC events:

(a) Always use the protective mask with outserts installed (unless your leader or technical reference states otherwise) when operating in cold climates to help prevent fogging.

(b) DO NOT warm up mask near heater or open flame. Masks could be damaged.

(c) Do not clear mask by exhaling a large amount of air into it (as done in warm weather). This might cause frosting of the cold eye lenses. Instead, exhale steadily and slowly.

(d) The outlet valve may stick to the seat. If this occurs, refer to the applicable technical order/manual.

(e) To don the protective mask in arctic conditions, personnel should take the following actions: stop breathing, remove mask from under parka (cold weather clothing), remove gloves or mittens as needed to properly don the mask, lower parka hood, and don and clear mask per the direction of leaders and the appropriate technical references. (Note: personnel may experience headache like symptoms when donning the protective mask in cold weather operations).

(f) Take the appropriate precautions when removing the mask to prevent perspiration from freezing on one's face and causing frostbite. Use small towel or cloth to wipe one's face and inside of mask. To prevent ice formation, wipe the mask thoroughly before storing it. When possible, further dry the mask by placing it in a warm, heated environment, but avoid placing it in direct heat.

(3) Chemical Protective Clothing. The current protective clothing issued to the armed forces will not be adversely affected by cold temperatures. Based on METT-TC and risk assessment, leaders will need to establish whether protective clothing is worn as an outer layer (over ECWCS) or as an undergarment (under ECWCS). The extreme cold weather clothing system (ECWCS) will provide only marginal protection in a chemical environment.

(4) Chemical Protective Overboots. Current bootcovers are worn seasonally, but do not fit over the cold weather vapor barrier (VB) boots. During cold weather operations the VB boots provide adequate protection when worn in conjunction with chemical protective clothing. The VB boots are double layered, natural rubber with an air pocket in between.

(5) Chemical Protective Gloves. Normal procedure when donning the protective gloves is to first put on the cotton liners and then the rubber gloves. During winter operations in a chemical environment, use the wool glove liners (as part of black leather glove set) under the butyl rubber gloves to absorb and wick away perspiration from hand surfaces. Proper glove fit is required to preclude restricting blood circulation and cold weather injury. In extreme cold environments, the arctic mittens should be worn over the rubber gloves to provide warmth. Decontamination of cold weather mittens (if contaminated) maybe impractical and hence considered as a combat loss.

(6) Nerve Agent Antidote Kit (NAAK). NAAKs are subject to freezing at about the same temperature as water. Therefore, when the temperature is below freezing the NAAK should be protected against freezing. Autoinjectors are normally carried in the protective mask carrier. During cold weather, when the temperature is below freezing, the injectors should be carried in an inside pocket close to the body. Should the NAAK become frozen they can be thawed out and used. Personnel also ensure that there is no transfer of contamination when the NAAK is placed into or withdrawn from an inside pocket.

(7) Antidote Treatment, Nerve Agent Auto-Injector System (ATNAA). Arctic weather affects the ATNAA system. When the temperature dips below freezing the ATNAA should be protected against freezing by removing it from the protective mask carrier and placing it in an inside pocket close to the body. Keep it as close to body temperature as possible. This precludes the danger of severe muscle spasms and/or shock from injecting an extremely cold liquid into a muscle. If the ATNAA is allowed to freeze, it will not be available for use until it is thawed. In addition, protect the ATNAA from freezing during transit, storage, and resupply operations. Care must be taken during the use of the ATNAA to ensure penetration through winter clothing to the muscle.

h. Monitor/Survey Operations/Equipment.

(1) Operations. Toxic chemicals react differently at extremely low temperatures. Some chemicals freeze at cold temperatures, thereby reducing the vapors which current detectors use to ascertain identification. Refer to the appropriate technical reference for equipment operation during cold weather monitor and survey operations.

(2) M256Al Chemical Agent Detector Kit. Arctic weather affects the kit. When temperature is -15°F (-21°C) or below, the kit can give inaccurate indications. Solutions in the capsules freeze, and the solutions will not work even if reheated. In addition, it is difficult or even impossible for the heat tabs to heat the enzyme window to a reaction temperature. Take care to keep the kit at a temperature above freezing. However, do not place the kit directly on a source of heat, such as a vehicle heater. If possible, warm it with body heat by placing it inside the parka. A system of identifying a sample of suspected agent is to collect the suspected agent and place it on M8 or M9 paper. Once collected, the M8 or M9 paper is warmed and covered in a box or can while the M256A1 kit is inside the box or can. This will heat both the suspected agent and kit sufficiently to enable detection by the M256A1 kit. Personnel can place samples into empty ammunition cans and apply

external heat to cause agent off-gassing. The external heat source may be a small fire or heat tab.

(3) Chemical-Agent Monitor (CAM) and Improved CAM (ICAM). At lower temperatures, most agent become more persistent or even freeze, and the ICAM/CAM will have difficulty in detecting agents. Cold weather will also shorten battery life. Refer to the technical reference for operating the ICAM/CAM in cold weather environments.

(4) M8 and M9 Detector Paper. Both M8 and M9 detector paper are not specifically limited in the cold but can detect only liquid agents. If the specific substance is thickened or frozen, a sample can be collected with a stick or scraper and wiped onto a sheet of either M8 or M9 paper. The sample is placed on a heated surface such as an operating vehicle or a power generator to stimulate thawing of the suspected agent so that identification is expedited. Because of the possibility of off-gassing, this procedure must not be performed inside a heated vehicle or tent.

i. Decontamination Operations.

(1) Operations. Refer to the appropriate technical and service publications for decontamination considerations and guidance with regard to cold weather environments.

(2) Equipment Decontamination. The use of water or five percent chlorine solution for decontamination will be limited during cold weather operations due impart to its freezing point (32 degs F). Alternatively, a dry mix of STB or HTH (two parts STB/HTH to three parts earth or snow) can be used. This method may require several applications at low temperatures. Application can be accomplished by shoveling the dry mix onto contaminated surfaces or filling sandbags and dusting it onto surfaces. After decontaminating, remove residual elements of the dry mix by brushing, scraping or using uncontaminated earth or snow to “wash” it off. These decontaminates are corrosive to metals and personnel must wear MOPP gear. Additionally, sorbent decontamination is also

limited during cold weather. Sorbent decontamination systems are based on absorbing liquid, and frozen agent cannot be absorbed.

(3) Personnel Decontamination. Time factors with regard to MOPP exchange or detailed personnel decontamination should be expanded with regard to cold weather conditions and the addition of the ECWCS.

j. Collective Protection. For COLPRO, chemical hazards present additional challenges. Cold weather operations use heated shelters; and shelters may or may not have collective-protection. However, fluctuations in pressure may occur when the system is exposed to high winds. In cold environments, indirect chemical vapor absorption presents the greatest problem during shelter entry and exit operations. For this reason, it is important to have a detection capability in the shelter itself. If agent is detected, personnel in the shelter will immediately mask. The personnel inside the shelter will be monitored to identify who has brought in the contamination. Once identification has been made, personnel exit and the shelter is then immediately purged. If follow-on detection proves negative, personnel may resume entry and exit procedures.

13. DESERT TERRAIN

10. Desert operations present many varying problems. Desert daytime temperatures can vary from 90°F to 125°F (32°C to 52°C). An unstable temperature gradient results, and this is not particularly favorable to NBC attacks. However, with nightfall, the desert cools rapidly, and a stable temperature gradient results. A possibility of night or early morning attacks must be considered in all planning of desert operations. Additionally, planners understand that hot temperatures can adversely impact NBC defense equipment/supplies during transit or storage. For information on specific items, check specific technical orders/technical manuals.

a. Nuclear. Nuclear defense planning is generally much the same in a desert as in other areas, but for a few exceptions. Lack of vegetation and permanent fixtures, such as forests and buildings, make it necessary to consider construction of fortifications. Construction may be difficult because of inconsistencies of the sand; but sand, in combination with sandbags, will give additional protection from radiation exposure. Blowing winds and sands can also produce widespread areas of radiological contamination.

b. Biological. Most aerosolized live biological agents at high temperatures are ineffective weapons in desert areas, but for a few. An exception is spore-forming biological agents. This is a result of low humidity and the ultraviolet radiation of direct sunlight. Personnel crossing or occupying desert terrain face little danger from long-term live biological contamination except for spore-forming agents; however, because of favorable night conditions, a covert aerosolized attack could occur. Toxins are resistant to this harsh environment, and could be employed in the same way as chemical agents.

c. Chemical.

(1) Chemical agents can be used in point or on-target attacks. This method can be used at high temperatures because of rapid agent evaporation. For example, with a neutral temperature gradient, 90°F (32°C) temperature, and light wind, sarin evaporates rapidly.

(2) Desert soil may be very porous. For example, an attack with an unthickened liquid agent may occur in support of a predawn attack. Soil soaks up agent. When the sun rises, it begins to heat the surface. The agent evaporates and rapidly creates a hazard because of a lack of vegetation and permanent buildings to alter the wind flow.

(3) A nonpersistent agent attack is unlikely during daylight hours. Weather conditions may rapidly blow away any agent. Night brings about a reverse of weather conditions and creates ideal conditions for an attack. At night, agents linger and settle into low areas, such as fighting positions.

(4) In planning for defense, plan any strenuous activity for night hours. This will reduce the heat stress caused by wearing MOPP gear. Take care to ensure that sleeping

personnel are masked, if appropriate. Also ensure that they are checked periodically to make sure that mask seals are not broken. This is because an attack is more likely at night than in the day. A way to accomplish this is to use the buddy system or to have the guards check personnel during rounds. The unit SOP must address this subject.

14. JUNGLE TERRAIN

11. Tropical climates require the highest degree of individual discipline and conditioning to maintain effective NBC defense readiness. Dominating climatic features of jungle areas are high, constant temperatures; heavy rainfall; and very high humidity. In thick jungle, there is usually little or no wind, and the canopy blocks much of the sunlight from the ground. Commanders must expect and plan for a rapid decrease in unit efficiency. They must also expect heat casualties. In addition, they must ensure that special precautions are taken to maintain unit NBC defensive equipment in usable condition. The rapid mildew, dry rot, and rust inherent in jungle areas impose this requirement.

a. Nuclear. Dense vegetation has little influence on initial effects of nuclear detonations except that the heavy canopy provides some protection against thermal radiation. The blast wave creates extensive tree blowdown and missile effects. Some falling particles are retained by the jungle canopy, and reduced radiation hazards may result. Subsequent rains, however, will wash these particles to the ground. Particles will concentrate in water collection areas and produce radiation hot spots.

b. Biological. Jungles provide excellent conditions for threat use of live biological agents. Warm temperatures, high humidity, and protection from sunlight all aid survivability of disease-causing microorganisms. Low wind speeds and jungle growth limit downwind hazards. Strict adherence to field sanitation procedures, especially vector and rodent control, is essential in jungles. These procedures will help control the naturally occurring diseases that abound. Personnel should mask and roll down sleeves to cover exposed skin from possible contact with live biological agents and toxins.

c. Chemical. Chemical agents used in jungle areas can cause extreme problems for friendly forces. Persistent agents delivered by artillery shells and aircraft bombs may penetrate the canopy before dissemination. These agents can remain effective on jungle floors for long periods. High temperatures can increase vapor hazards from liquid agents. Nonpersistent agent vapors hang suspended in the air for extended periods because of low wind speeds. However, these wind speeds minimize downwind vapor hazards. Chemical agents employed in jungle areas make MOPP gear necessary for ground operations. However, high temperatures and humidity combined with the heat-loading characteristics of MOPP gear increases heat degradation.

15. MOUNTAIN TERRAIN

12. Terrain and weather in mountainous areas dictate a requirement for a high degree of NBC defense preparedness. Rugged terrain limits the employment of large forces. Adjacent units may not be able to provide mutual support. Also, there may be reduced logistical support and difficulty in achieving rapid maneuver. In these circumstances, small US units can impede, harass, or canalize numerically superior threat forces. The intention is to dissipate threat strength and compel threat forces to fight a decisive battle under unfavorable circumstances. Mountain warfare requires friendly units to be almost completely self-sufficient in NBC protection.

a. Nuclear. Nuclear targeting in mountainous areas is easier than in flat terrain. The reasons are the lack of roads and trails and the slow speed at which personnel must move. Preparing fighting positions and building other protective shelters are difficult in rocky or frozen ground. Improvised shelters built of snow, ice, or rocks may be the only possible protection. Radiological contamination deposit may be very erratic, because of rapidly changing wind patterns. Hot spots may occur far from the point of detonation, and low intensity areas may occur very near it. Limited mobility makes radiological surveys on the ground difficult, and the difficulty of maintaining a constant flight altitude makes air surveys highly inaccurate. Natural shelters provide some protection from nuclear effects and radiological contamination. These natural shelters include caves, ravines, and cliffs. Clear mountain air extends the range of casualty-producing thermal effects. Added clothing required by cool mountain temperatures, however, reduces casualties from these effects. Units operating under nuclear warfare conditions should also carefully select positions where they will not be hit or trapped by slides.

b. Biological. Defense against live biological agents does not differ in principle in mountains from that in flat terrain except for extreme cold considerations.

c. Chemical. Aerial delivery will likely be the means of chemical munitions employment in mountain warfare. Personnel should be constantly alert for aerial strikes, and they should take protective actions immediately. Defense against chemical attacks in mountains is similar to that in flat terrain.

16. URBAN TERRAIN

13. To plan NBC defense, commanders must be familiar with how urban terrain will affect their mission in an NBC environment. For example, the TIM density will likely increase in an urban area; the downwind transport of aerosols will be influenced by the unique micro-meteorological considerations in urban terrain (i.e., increased thermal buildup, "thermal islands"), and there will be a larger number of noncombatants.

a. Nuclear. Without additional preparation, unreinforced buildings give inadequate shelter from a nuclear blast. If used correctly, ground floors and basements of steel or reinforced concrete offer excellent protection from most effects except overpressure. Personnel should avoid windows because of possible injuries from flying debris and glass. Personnel also may receive severe burns through openings facing ground zero. Storm drains and subway tunnels are readily available in most urban areas. These provide better protection than ground-level buildings. Personnel should not use structures of wood or other flammable materials, because these could burst into flames. Buildings do provide a measure of protection against radiological contamination; and personnel may travel through buildings, sewers, and tunnels. However, they should consider the dangers of collapse because of blast. Personnel should also consider hazards of debris and firestorms resulting from ruptured and ignited gas or gasoline lines.

b. Biological. Buildings and other urban structures can provide some immediate protection from direct spray. However, the stable environment of these structures may increase persistency of biological agents. Toxins are very effective in an urban environment, and personnel should take the same precautions prescribed for chemical agents. Pound for pound, biological agents are more toxic than chemical agents; and agent effects are especially magnified in an enclosed area. Covert operations are particularly well suited for urban terrain. Existing water and food supplies are prime targets. Personal hygiene becomes increasingly important. Commanders must establish and consistently enforce sanitary and personal hygiene measures, including immunizations. They must also ensure that personnel drink safe water and never assume that hydrant water is safe.

c. Chemical. Urban structures can protect against spray attacks, but this exchange for overhead cover creates other problems. Generally, chemical agents tend to find and stay in low areas, such as those found in urban locations. Examples are basements, sewers, and subway tunnels. Personnel should avoid these low areas. Stay times of agents, such as sarin (GB), greatly increase when settled in these areas. Once an attack occurs, detection of chemical contamination becomes very important. Personnel must thoroughly check areas before attempting to occupy or traverse them.

17. LITTORAL ENVIRONMENT

14. During operations at the sea-land interface, multiple considerations impact NBC defense operations. For example, land and sea breezes occur almost daily in tropical and mid-latitude regions on the coast of all islands and continents. They occur because the

land cools and heats more rapidly than the adjacent water. Therefore, the commander must be concerned about potential offshore CB agent threat.

Chapter IV

SUSTAINED OPERATIONS IN AN NBC ENVIRONMENT

The modern battlefield and threat of NBC weapons pose significant challenges to leaders and their units. Based on those challenges this chapter addresses the impact of the NBC environment as it affects the performance of individuals, and units. The chapter provides insights into the degradation to be expected from enemy employment of NBC weapons, and provides suggested guidance for maintaining operational tempo in the NBC environment. The basic goals remain to avoid or minimize the impact of the contamination and to enhance endurance and task performance. When individuals are encapsulated in these ensembles, they are subjected to both physiological and psychological stresses; however, given an understanding of the NBC environment and its impact and proper training, individuals can perform assigned tasks successfully for a considerable period of time. The NBC environment impacts leaders and subordinates from different aspects. Leaders provide the necessary command and control to insure successful operations; and leaders must train themselves to know what to expect and to recognize common pitfalls. Subordinates, on the other hand, must focus on the accomplishment of individual and collective tasks.

18. PHYSIOLOGICAL AND PSYCHOLOGICAL IMPACT OF AN NBC ENVIRONMENT

a. Physiological and Psychological Impact. There are physiological and psychological factors that are common to military operations and also to operations in the NBC environment. A number of these factors can contribute to decreased tolerance due to the effects of operations in an NBC environment (See Figure IV-1). Because these factors are amplified in an NBC environment, leaders and their subordinates are alert for those factors that can impact mission operations (see Figure IV-2). Leaders are also aware of psychological issues that can be magnified by an NBC environment (i.e., individuals may become depressed or hyperactive or depressed) (see Figure IV-3).

- Disease
- Dehydration
- Heat
- MOPP gear
- Exhaustion
- Workload
- Food Deprivation
- Isolation

Figure IV-1 Factors That Influence Decreased Tolerance

b. Impact on Leaders. A major element of leadership is that the leader must take care of himself as well as his personnel. Leaders are subject to the same degradation that can befall their personnel. Leader neglect can result in them becoming a casualty. The NBC environment places tremendous stress on the leader (see Figure IV-4), and leaders may display actions and attitudes that affect their effectiveness (i.e., less leader adaptability; move leader casualties). To help mitigate this consideration, confidence is developed during stressful NBC training.

PHYSIOLOGICAL DEGRADATION

- Nervous
- Trembling
- Sweating
- Heart pounding
- Dry mouth
- Headache
- Tired
- Nausea

Leaders and service personnel observe and assess their own status.

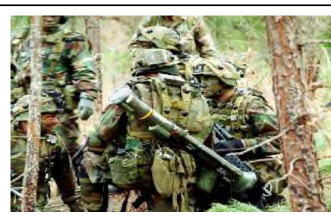
PSYCHOLOGICAL DEGRADATION

- Forgetful
- Inattentiveness
- Decreased confidence
- Frustration
- Difficulty concentrating
- Startled response to noise
- Uncooperative behavior

Figure IV-2. Common Signs of Physiological and Psychological Degradation

c. Impact on Individuals. Just as leaders were impacted by operations in an NBC environment, there are many stressors (see Figure IV-5), that impact an individuals ability to function in an NBC environment. For example, even though personnel became dehydrated, they did not feel thirsty, thus they did not practice forced drinking. MOPP 4 can increase perceptions of respiratory distress, and decrease clear thinking. Personnel also

- Lack of movement
- Constant movement
- Argumentative
- Jerky movement



- Slow reaction
- Rapid talking
- Anxious
- Lack of facial expression

may began to take dangerous shortcuts and make mistakes while performing tasks. Crews in closed vehicles in MOPP 4 can experience motion sickness, and individuals operating in high elevations in MOPP 4 can experienced serious degradation, and require up to 4 days to adjust to higher elevations.

Figure IV-3. Depression/Hyperactivity Behaviors

Leaders Demonstrate Less	Leaders Demonstrate More
Less adaptability.	More exhaustion.
Less delegation.	
Less sleep.	More irritable and impatient.
Less effective communications.	More Easily lost.
Less leadership effectiveness	More leader casualties (after 6 hours).
Less clarity/concisence in OPORDS.	More micromanagement.
Less initiative from subordinates to take orders.	More omission of critical items in OPORD.
	More periods when no one in charge (after leader becomes casualty).

Summary: Units do poorly where leaders have less NBC training; and conversely, units whose leaders are NBC trained, do better even if their personnel had little NBC training.

Figure IV-4. Impact of an NBC Environment on Leaders

IMPACTS

- Less clear thinking
- Restricted field of vision
- Manual dexterity degraded
- More concentration required
- Perceive respiratory stress

Figure IV-5 Impact of an NBC Environment on Personnel

- Dehydration
- Degraded communications
- Degraded vision
- Mistakes increase
- Becomes careless

19. IMPACT OF NBC ENVIRONMENT ON OPERATIONS

15. Since NBC weapons can be delivered by multiple means, all phases of military operations could be severely impacted. Command and control, maneuver, fires and communications are all examples of functional areas that can be impacted by operations in an NBC environment.

a. Command and Control. Command and control can suffer significantly in an NBC environment. Because of physical and mental fatigue leaders were slower to respond to changing situations, delegated less and performed more staff tasks themselves. Other observations include –

- Leadership judgement and response to changing situations was less effective.
- Tasks dealing with accuracy of reports, coordination of fire plans and issuance of operation orders were degraded.
- Intelligence gathering assets such as scouts were degraded, resulting in less timely and detailed information to the commander.
- Clarity and conciseness of operations orders diminished rapidly, and leaders omitted essential items of information.
- Commanders required more time to prepare orders.
- Commander's plans for and control of direct and indirect fires deteriorated with time.
- Tactical commanders had a tendency to focus inward and were less aware of adjacent units.

b. Maneuver. Synchronization of tactical maneuver is more difficult in the NBC environment. Control of units, timing of operations and ability to adhere to the scheme of maneuver can be degraded. Specifically, units can incur additional risks when operating in an NBC environment. The additional risks (see Table IV-6) can manifest themselves in many ways. For example, units may miss objectives (i.e., units get lost), units lose more combat vehicles to enemy fire; and the ability to control units is degraded. Overall, the vulnerability of forces can increase over time, the longer a unit operates in MOPP4.

c. Fires. Both direct and indirect fires weapons effectiveness, can decrease in an NBC environment. Target detection and acquisition is much more difficult. For example, personnel conducting target acquisition acquired targets at considerably shorter distances, land force combat fighting vehicles fired fewer rounds, and infantry fighting vehicles tended to fight at closer ranges. Further, fewer small arms engagements and anti-tank and missile rounds expenditures occurred. Other considerations included –

- Battle losses increased as units spent longer periods in NBC protection.
- Engagement range for direct fire weapons decreased.
- Fratricide engagements increased
- Battle intensity in the attack was considerably lower.
- Ability of indirect fire to support the direct-fire battle was degraded.
- Time to prepare and transmit live-fire requests for voice/digital transmission increased; and the time to prepare indirect weapons for firing took longer.

Table IV-1. Observations of Units Operating in a NBC Environment

POTENTIAL RISKS FROM OPERATIONS IN AN NBC ENVIRONMENT
• Units selected easier routes – Units advanced on expected avenue of approach.
• Units used tighter formations - Less unit dispersal.
• Unit hesitated to be aggressive - Less unit initiative.
• Unit attacks took longer – More unit casualties.
• Unit conducted slower rates of travel – Increased time to accomplish missions.
• Unit fire effectiveness decreased – Unit loss exchange, ratios decreased.

• Unit demonstrated degraded ability to perform mission when buttoned up – Decreased combat team effectiveness.
• Unit killed fewer threat targets killed during offensive operations – Unit combat advantage degraded.
• Unit intelligence collection assets (i.e., scouts) had difficulty in seeing and hearing enemy - Unit target acquisition/intelligence collection degraded.
• Individual/crew endurance degraded (i.e., tank crews operating in hot weather in MOPP 4, were not able to perform their mission longer than 3-6 hours) - Combat power decreased

d. Communications. The effectiveness of communications, both face to face and via radio can deteriorate in an NBC environment. Hearing, seeing and visual recognition are degraded. The specific impact of and NBC environment can include -

- Voice recognition diminished, leading to repeated requests for call signs.
- Personnel used hand signals more often.
- Message length doubled.
- Number of radio messages increased.
- Longer transmission times increased vulnerability to enemy electronic warfare (EW).

20. IMPACT OF NBC ENVIRONMENT ON SUSTAINMENT

16. Sustaining combat operations in NBC environments presents major challenges. Operations will be slowed as task performance both complex and simple, can be encumbered by wear of IPE. Degradation can be found in all areas of sustainment to include the establishment and operations of logistical sites, movement of supply vehicles, maintenance, medical support, and NBC defensive operations.

a. Establishment and operation of logistical sites. The impact of an NBC environment can result in less dispersal of forces and camouflage of vehicles. Setup of sites such as class III refuel points took longer; key safety measures were not as closely followed, and units processed fewer supply requests.

b. Movement. Movement times for logistical packages increased. Drivers experienced more fatigue and reduced dexterity resulting in increased time to process supplies. Consumption of diesel fuel also increased due to greater distances traveled. More time was required to move to subsequent battle positions, and there were overall slower rates of travel.

c. Maintenance. Operations was adversely impacted by factors such as poor communications and incorrect diagnosis while in MOPP4. For example, maintenance teams frequently did not carry appropriate tools to the work site, onsite repairs took longer, safety measures were not strictly adhered to, and maintenance was often deferred until MOPP levels were reduced.

d. Medical. Medical operations degradation occurred due to factors such as fatigue and reduced dexterity of medical personnel. The times required to conduct activities such as setting up medical facilities, conducting triage, measuring patient vital signs, and administering medications all increased.

21. EXECUTING COUNTERMEASURES

17. Military leaders know that all phases of military operations can be degraded by an NBC environment, but some areas are more degraded than others. If leaders know what to expect, they can moderate the expected degradation. Comprehending the affect of an NBC environment on units mission accomplishment can be achieved through –

- Performing mission essential tasks such as C^2 regularly in MOPP 4.
- Conducting target acquisition and identification for individual and crew served weapons.
- Exercising communications functions to ensure effective and efficient results.
- Anticipating additional sustainment requirements – more water consumption, increased wear and tear on IPE, etc.
- Striving for simplicity in plans.
- Understanding the impact of MOPP 4 on mobility.

a. Background. Preparation for operation in an NBC environment is critical to successful operations. Preparation must emphasize individual/crew readiness. It is important that units focus on performance of mission tasks under NBC conditions, because it leads to improvements in performance and to endurance of individuals and crews. Individuals learn which tasks can be performed in MOPP with little or no modification and which tasks require the development of work-arounds or deferment until MOPP can be reduced.

b. Leader preparation. Leader preparedness for operations in the NBC environment is extremely important. Effective leader countermeasures include –

- Leaders observe their personnel to know and recognize the signs of serious physiological and psychological degradation.
- Leaders use coping strategies to deal with physical and mental aspects of the NBC battlefield.
- Leaders focus on the maintenance of high physical standards for all personnel, thus facilitating endurance.
- Leader know that they could become a casualty, and continually assess their personal status.
- Leaders pace themselves and plan for rest and sleep periods, especially as the periods in MOPP 4 extend.
- Leaders rely on their staff more and allow subordinates more latitude, thus avoiding the tendency to micro-manage.
- Leaders focus on attention to detail in the planning and development of operations orders and fragmentary orders.
- Leaders plan for more efficient use of their time.

c. Individual preparation. Readiness for the individual must focus on ways to effectively operate in an NBC environment. Individual preparation must include-

- Ensuring that NBC protective equipment is properly used and maintained.
- Ensuring understanding of the need to drink adequate amounts of fluids, and to recognize the symptoms of dehydration.
- Performing tasks in MOPP4, and to do so for extended periods of time.
- Recognizing the need develop work-arounds for those difficult tasks that must be accomplished. Individuals share this information with their buddies, and inform leaders.

- Focusing on the physiology and psychology of encapsulation in MOPP4 so as to understand the impact.
- Understanding hyperventilation and development of breathing techniques while masked.
- Talking slower and more clearly through the mask.
- Understanding and using work-rest cycles.
- Focusing on task completion versus time required.

d. Preparation for crews, teams, and units. In that all tasks are degraded to some extent, the necessity for teams and units to maintain their unit cohesion and OPTEMPO become critical. Key factors that should be considered include –

- Conducting tasks in MOPP 4 for extended periods.
- Focusing on cross-training of teams and crews.
- Using work-rest cycles and sleep periods for crew members.
- Emphasizing that basic survivability functions cannot be ignored, especially tasks such cover and concealment.
- Developing "buddy systems" to keep a check on individuals within the unit detect serious degradation.
- Using arm and hand signals to facilitate routine communications.
- Using a system of identification of individuals within the unit.

Chapter V
MOPP ANALYSIS

This chapter addresses the guidance for determining appropriate levels of protection in an NBC environment (MOPP analysis) and MOPP levels.

22. MOPP ANALYSIS

18. During the pre-attack phase, NBC personnel use NBC threat, environmental, and mission related information to provide recommendations on protection requirements Medical personnel also provide recommendations to ensure safe and sustained operations under various climatic conditions. The commander and staff should develop standard responses and courses of action for each projected mission. After attack, NBC personnel use information collected to identify the type of agent used, the likely duration of exposure, and minimum protection requirements. Leaders know they cannot expect the same work rates in MOPP 4 as they achieved in MOPP 0. They re-evaluate their ability to meet mission requirements and communicate changes to their forces. Should they neglect to provide additional resources or adjust task completion times, first-line supervisors may assume the mission is critical and try to maintain the original timelines. Depending on the task and climate, the short and long-range consequences to personnel may range from insignificant (cool or mild) to catastrophic (hot and dry). MOPP reduction decisions are also among the most difficult to make because of the many considerations that affect the final decision. Commanders must evaluate the situation from both force protection and mission perspective. Factors include the criticality of the current missions, potential effects of personnel exposure, and impact on the casualty care system. The commander and staff can then determine what follow on courses of action to employ. Leaders determine the appropriate MOPP level by assessing the NBC threat, environmental factors, and the mission factors; and weigh the impact of increased levels of protection (and reducing the risk of CB agent exposure) and the increased risk of heat strain as protection levels increase. (see Figure V-1).

a. MOPP Analysis-Mission Factors. To support analyzing mission factors, the following questions can be asked:

- What is the mission?
- What additional protection (such as collective protection) is available?
- How physically and mentally demanding is the mission that must be performed (i.e., work intensity)?
- How quickly must the mission be accomplished?
- What is the expected duration of the mission?

MOPP ANALYSIS
❖ **MOPP Analysis Considers**:
• Mission Factors.
⇒ Work Intensity.
⇒ Duration of Mission.
• Environmental Factors:
⇒ Ambient Air Temperatures.
⇒ Humidity.
⇒ Day/Night.
⇒ Cloudy/Sunny.
• NBC Threat Status:
⇒ Serial 1.
⇒ Serial 2.
⇒ Serial 3.
⇒ Serial 4.
• MOPP Analysis Provides: Recommended MOPP Level.

Figure V-1. MOPP Analysis

- What is the likely follow-on mission?
- Are adequate water and food supplies available?

(1) The type of mission will directly impact the work intensity (see Appendix C), and MOPP analysis must consider the key issues such as mission duration, environmental factors and the NBC threat.

b. MOPP Analysis-Environmental Factors.

(1) To support analyzing environmental factors, the following questions can be asked:

- What is the ambient air temperature?

- What is the humidity?
- What is the wet bulb globe temperature (WBGT) index reading for the unit's AO?
- Is it cloudy or sunny?
- Is it windy?
- Is it day or night?

(2) Guidance for prevention of heat injury and illness can be based on WBGT readings. The WBGT reading provides a single measure of the major determinants of environmental heat stress (for example, air temperature, wind speed, solar load, and humidity). Although the WBGT provides an adequate representation of the heat stress under most conditions, it is not perfect and should be interpreted as approximate guidance. For instance, it was not optimized for conditions commonly seen in environmental extremes, such as the desert. Guidance based on the WBGT is appropriate only for personnel who are fully acclimatized, optimally conditioned, hydrated, and rested. Additionally, WBGT guidelines do not accurately forecast injury/illness rates under conditions of lower temperatures and high humidity such as may be experienced in the early morning hours; and humidity levels over 75 percent substantially increase the risk of heat injury under all work conditions.

Note: see Appendix C for detailed information on human factors effects that can be caused by the wearing of MOPP gear. Appendix C also provides information on suggested work-rest cycles while wearing MOPP gear.

c. MOPP Analysis - NBC Threat. Leaders consider using NBC threat status (i.e., serials 1 through 4) as another tool in considering what protection level should be used.

(1) Background. US forces may not have to carry IPE (such as MOPP) based on the initial threat estimate. If the threat condition were to change and indicators were present to suggest the possible use of NBC agents by the threat forces, IPE would be deployed forward. The minimum NBC threat status can be set at by major subordinate commands (i.e., division/separate brigade, group, wing, etc.), and is a flexible system determined by the

most current enemy situation. Key factors in the threat status assessment include likely targets, threat agents, and warning time. The NBC threat status serial numbers are for planning purposes; and the actual NBC threat status serial numbers used in a theater of operation may vary from the information furnished in this appendix. These numbers, however, may be substituted for a color code (example colors could include serial 1 = white, serial 2 = yellow, serial 3 = red, serial 4 = black). It does, however, require NBC personnel to stay abreast of the intelligence situation.

(2) Serial 1. An adversary does not possess any IPE, is not trained in NBC defense or employment and does not possess the capability to employ NBC warfare agents or systems. Further, the adversary is not expected to gain access to such weapons, and if they were able to gain these weapons, it is considered highly unlikely that the weapons would be employed against US forces.

(3) Serial 2. The adversary has an offensive NBC capability and has received training in defense and employment techniques, but their assessment is no indication of the use of NBC weapons in the immediate future. Based on Serial 2, personnel may be directed to carry IPE.

(4) Serial 3. The adversary is equipped and trained in NBC defense and employment techniques. NBC weapons and employment systems are readily available. NBC weapons have been employed in other areas of the theater. Continued employment of NBC weapons is considered probable in the immediate future. Unit actions may include directing individuals be at MOPP1 or MOPP2; or MOPP0, if MOPP gear is readily available.

(5) Serial 4. The adversary possesses NBC warfare agents and delivery systems. IPE is available and training status is considered at par or equal to that of the US. NBC weapons have already been employed in the theater and attack is considered imminent. .

Unit actions may include personnel wearing their overgarments or having them readily available.

d. Use of MOPP Guidance. Leaders apply mission, environmental and NBC threat information, to help determine what MOPP level is appropriate for their unit's particular situation.

(1) Higher headquarters (i.e., wing/corps/group/JTF) provides directives to subordinate element that will include a MOPP level. Subordinate units apply flexibility and initiative to this guidance to account for local conditions. Failure to do this exposes units to far greater hazards in the form of heat casualties, direct fire losses, and mission failures. The following techniques offer guidance for applying the guidance offered by a higher headquarters. Once MOPP levels are established by higher headquarters, subordinate units may not downgrade from this level except for the following reasons:

- Consistent with the risk, units may temporarily reduce MOPP levels to conduct decontamination operations such as MOPP gear exchange.
- Personnel inside enclosures may reduce MOPP level at the discretion of the section/flight/platoon leader or higher commander. The enclosure need not be airtight but should be capable of protecting against the initial liquid hazard.

(2) Land forces may make decisions on increasing or modifying MOPP posture at the tactical level (i.e., squad and platoon level). Small units like platoons frequently conduct independent operations; therefore, the unit leader's training and experience are essential to successful operations under NBC conditions. Directives received by small tactical units should also indicate a minimum MOPP level; and if needed, a percent of personnel masked. In some cases the guidance received by battalion or equivalent will be passed unaltered down to team/section/squad level.

23. MOPP LEVELS

19. In confronting an NBC threat, the MOPP analysis process can be used to help develop protection levels (controls). The MOPP analysis process can be used as a tool to support determining the appropriate protective posture; estimating unit/personnel effectiveness (i.e., mission degradation), estimating additional logistics requirements (i.e., water resupply, IPE replenishment, etc), and assessing/weighing the tradeoffs between agent exposure versus degraded performance (i.e., wearing of MOPP 4).

a. Standard Mission-Oriented Protective Posture.

(1) Background. Leaders are familiar with standard MOPP levels; and familiarity with these levels aids in making rapid and educated decisions. Standardized MOPP levels allow leaders to increase or decrease levels of protection through the use of techniques such as readily understood prowords. Leaders determine which protective posture their subordinate units will assume (See Tables V-1 and V-2), and then direct their units to assume that MOPP level. Leaders are also aware the shipboard application of MOPP level will varies from ground force MOPP (See Table V-1 for the differences). The commander's or leader's directive also can include, based on the threat, the percentage of personnel that will mask: for example, MOPP1, 50 percent masked. The system is flexible, and subordinate leaders can modify their unit's MOPP level to meet mission needs. The following standardized protective postures also assume that personnel are also carrying their individual decontamination kit, M8/M9 detector paper, nerve agent antidote, and their protective mask.

(2) MOPP Ready (Applies to USA/USMC only). Personnel carry their protective masks with their load carrying equipment (LCE). The individual's MOPP gear is labeled and stored no further back than a logistics site (i.e., brigade support area) and is ready to be brought forward to the individual when needed. Pushing MOPP gear forward should not exceed two hours. Units in MOPP Ready are highly vulnerable to persistent agent attacks and will automatically upgrade to MOPP Zero when they determine, or are notified, that

NBC weapons have been used or that the threat for use of NBC weapons has risen. When a unit is at MOPP Ready personnel will have field-expedient items such as wet weather gear identified for use in the event of an unanticipated NBC attack.

(3) MOPP Zero. IPE is issued to and inspected by the individual and prepared for use. Personnel carry their protective masks with their LCE. The standard issue overgarment and other IPE making up the individual's MOPP gear are carried or readily available. To be considered readily available, equipment must be either carried by each individual, stored within arms reach of the individual, or be available within five minutes. For example, within the work area, vehicle, or fighting position. Units in MOPP Zero are highly vulnerable to persistent agent attacks and will automatically upgrade to MOPP1 when they determine, or are notified, that persistent NBC weapons have been used or that the threat for use of NBC weapons has risen. The primary use for MOPP Zero is during periods of increased alert when an enemy has a chemical/biological employment capability, but there is no indication of use in the immediate future.

(4) MOPP1. When directed to MOPP1, personnel immediately don the overgarment. In hot weather, the overgarment jacket can be left open or removed, and the overgarment can be worn directly over underwear and other IPE making up the individual's MOPP gear (i.e., footwear covers, mask, gloves are readily available or carried). M9 or M8 NBC detection paper is attached to the overgarment, and carry or keep at hand nerve agent antidotes and decontamination kits. MOPP1 provides a great deal of protection against persistent agent. This level is automatically assumed when NBC weapons have been employed in an area of operations or when directed by higher command. The primary use for MOPP 1 is when a chemical/biological attack in theater is possible. Personnel remove contact lenses and wear protective mask spectacles. Leaders also monitor hydration levels.

(5) MOPP2. Personnel wear and/or put on their IPE's footwear covers, overgarment and the protective helmet cover. As with MOPP1, the overgarment jacket may be left open or removed, but trousers remain closed. The mask with mask carrier and gloves are carried. The primary use for MOPP 2 is when a chemical/biological attack in theater is possible. Personnel carry or keep at hand M8/M9 paper, nerve agent antidotes, decon kits, wear protective mask spectacles, and maintain hydration levels.

(6) MOPP3. Personnel wear the overgarment, footwear covers, protective mask and helmet protective cover. Again, flexibility is built into the system to allow personnel relief at MOPP3. Particularly in hot weather, personnel can open or remove the overgarment jacket and roll the protective mask hood for ventilation, but trousers remain closed. The protective gloves are carried, and the primary use of MOPP3 is when an attack is imminent. The primary use of MOPP3 is for personnel operating inside areas where their mission requires tactility but a contact hazard does not exist. (Note: MOPP3 is not appropriate if a contact hazard is present).

(7) MOPP4. Personnel completely encapsulate themselves by closing their overgraments; adjusting all drawstrings to minimize likelihood of any openings; and putting on their protective gloves. MOPP4 is used when the highest degree of protection is required, or CB agents are present but the actual hazard is not determined. As with every other MOPP level flexibility is built into the system to provide relief to the individual. Once the hazard has been identified and risk assessment measures employed, the overgarment may be left open.

b. MOPP Options.

(1) Mask Only. The mask is worn with the long sleeve duty uniform (for limited skin protection). The Mask Only command may be given under these situations:

- When riot control agents (RCA) are being employed and no chemical/biological threat exists.
- In a downwind vapor hazard of a CB agent.

CAUTION

MASK ONLY is not normally an appropriate command when blister or nerve agents are involved.

NOTE

Commander's must understand that MOPP differences exist in different locations and situations. Table V-1 depicts these MOPP differences.

Table V-1. MOPP Differences

MOPP DIFFERENCES (AFLOAT vs ASHORE)			
AFLOAT*		**ASHORE****	
AFLOAT MOPP	AFLOAT DESCRIPTION	ASHORE MOPP	ASHORE DESCRIPTION
		MOPP Ready	Carry Mask; IPE Nearby
		MOPP 0	Carry Mask; IPE Available
MOPP 1	IPE Available	MOPP 1	Don Overgarment
MOPP 2	Activate installed detectors, Carry mask, post M8/M9 detector paper.	MOPP 2	Don Protective Boots
MOPP 3	Don protective suit, mask, and boots, activate intermittent countermeasures washdown (CMWD).	MOPP 3	Don protective mask
MOPP 4	Don protective gloves, Circle William; CMWD.	MOPP 4	Don protective gloves
*USN, USCG, MSC Vessels		** USN, USMC, USA, USAF personnel	

[1] The term "<u>mask</u>" includes any form of respiratory protection against N, B or C hazards as issued by services. ² IPE must be available to the service members within 2 hours. Second, set available in 6 hours. [3] IPE within arms reach of personnel.

(2) No BDUs. Individuals when directed, wear the overgarment over underwear when heat stress is expected to be a significant factor; however, this variation increases the risk of skin contamination.

c. Automatic Masking.

(1) Automatic masking is the act of immediately masking and assuming MOPP3 when encountering CB attack indicators.

(2) Before CB weapons usage is confirmed, personnel will don the mask when there is a high probability of CB attack. When chemical agents have been employed, commanders at all levels may establish a modified policy of automatic masking by designating additional events as automatic masking criteria. Once this information is disseminated, personnel will mask and assume MOPP4 automatically whenever one of these events occurs. Automatic masking criteria should be used by the commander as a decision tool and is based on NBC IPB, risk assessment, and METT-TC. Subordinate commanders may add automatic masking criteria at their discretion. High probability CB attack indicators can include:

- Sounding of a chemical agent alarm.
- Positive reading on chemical agent detector paper or chemical-agent monitor.
- Personnel experiencing symptoms of chemical agent poisoning.

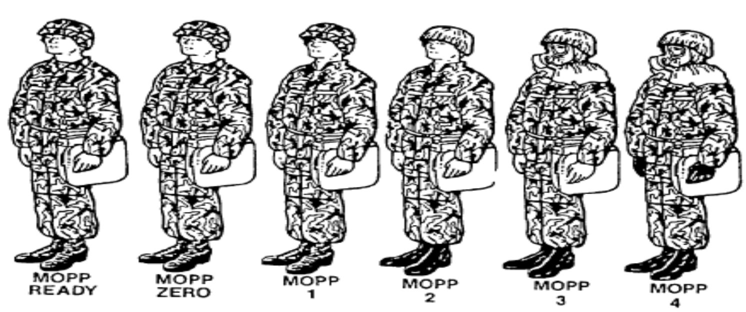


Table V-2. Standardized MOPP Levels For Ground Based Forces*

MOPP EQUIPMENT	**MOPP LEVELS**					
	MOPP READY	MOPP ZERO	MOPP 1	MOPP 2	MOPP 3	MOPP 4
Mask	Carried[1]	Carried[1]	Carried[1]	Carried[1]	Worn	Worn
*Overgarment	Ready[3]	Available[4]	Worn[5]	Worn[5]	Worn[5]	Worn
Vinyl Overboots	Ready[3]	Available[4]	Available[4]	Worn	Worn	Worn
Gloves	Ready[3]	Available[4]	Available[4]	Available[4]	Available	Worn
Helmet Protective Cover	Ready[3]	Available[4]	Available[4]	Worn	Worn	Worn
Chemical Protective Undergarment	Ready[3]	Available[4]	Worn[2]	Worn[2]	Worn[2]	Worn

[1] The term **"mask"** includes any form of respiratory protection against N, B or C hazards as issued by Services.
[2] The Chemical Protective Undergarment (CPU) is worn under the BDU (primarily applies to SOF and Aviation).
[3] Must be available to the service members within 2 hours. Second, set available in 6 hours.
[4] Within arms reach of personnel.
[5] Recognizing risk management the suffix **"Jacket Open"** or **"Jacket Off"** can be added to dress categories 1, 2, or 3; together with any other adjustments needed to meet local conditions.
* The type of overgarment may vary among the services (i.e., BDO, JSLIST, CPOG, Saratoga, etc).

d. Identification of Personnel in MOPP. Identifying personnel in MOPP can be accomplished through various means. Personnel follow the guidance prescribed in service technical manuals or technical orders. However, one way is to use tape that would indicate the individual's rank and first and last name. (Note: Blood type and religion are optional data entries). When personnel are not in MOPP, a strip of tape with all the information already printed on it can be placed on the individual's helmet (front and back), mask canister or overgarment bag, as well as on the mask carrier. When overgarments are put on, personnel can pull the tape off the overgarment bag and place it on their overgarment to further increase ease of identification.

e. MOPP System Flexibility.

(1) MOPP is not a fixed or rigid system. Flexibility is the key to providing maximum protection with the lowest risk possible while still allowing mission accomplishment.

Flexibility allows subordinate commanders to adjust the amount of MOPP protection required in their particular situations and still maintain combat effectiveness. Additionally, commanders can place all or part of their units in different MOPP levels or authorize variations within a given MOPP level. For example, based on a high probability of a chemical attack, two individuals man an observation post. One individual wears a mask and the other does not. This ensures that if a sudden attack occurred, one individual would already be masked and would not become a casualty.

(2) Personnel (when directed) may leave the overgarment jacket open at MOPP1, MOPP2, or MOPP4, allowing greater ventilation. Personnel may leave the hood open or rolled when the mask is worn. Commanders decide which of these variations to use based on the threat, temperature, and unit work intensity.

(3) Personnel wear protective gloves at MOPP1 through MOPP4 when handling equipment that has been decontaminated. This prevents contact with agent that may have been absorbed by equipment surfaces.

(4) Where the hazard is from residual nuclear effects (for example, fallout), the commander modifies MOPP level based on his assessment of the situation and criticality of the mission. MOPP gear does not protect against gamma radiation. However, wearing of MOPP gear can reduce radiological hazards from beta particle burns and alpha particle ingestion. these radiological hazards. A primary concern is to reduce the amount of radioactive contamination that contacts the skin and to prevent ingestion of radioactive particles.

f. Impact of MOPP.

(1) Personnel wearing MOPP4 with mask will take about 1.5 times longer to perform most tasks. Therefore, leaders can estimate the time it will take to complete most tasks in MOPP4 with mask by multiplying the time normally required to complete tasks by 1.5.

(2) Decision-making and precision control tasks are slowed even more than manual tasks. For decision-making and precision control (for example, typing a message or aiming) tasks, the normally expected completion time should be multiplied by 2.5 (or more, if personnel have been in MOPP4 with mask for an extended period or are overheated).

(3) Well-prepared personnel suffer less stress when in MOPP than do personnel who are less prepared. Well-prepared personnel are those who are in good physical condition and have trained extensively in protective gear. Physically fit personnel are more resistant to physical and mental fatigue and acclimatize more quickly to climatic heat or the heat associated with MOPP wear than less fit personnel.

(4) Units that anticipate deployment to regions where employment of chemical/biological agents is possible should augment physical training programs and increase their state of heat acclimatization. To optimize heat acclimatization, personnel should progressively increase the duration (reaching two to four hours) and intensity of exercise in the heat over 7 to 14 consecutive days. Finally, when personnel are required to routinely work in MOPP gear, it is important to practice good hygiene; and keep skin clean to avoid developing heat rash that can dramatically reduce the ability to regulate body temperature.

Chapter VI
INDIVIDUAL PROTECTION

The armed forces of the United States must be prepared to conduct prompt, sustained, and decisive combat operations in NBC environments. An adversary's NBC capabilities can have a profound impact on US and multinational objectives, campaign plans, and supporting actions, and therefore must be taken into account during the planning and conduct of combat operations. To accomplish this goal and assist in the protection of the force, the armed forces of the United States use individual protective measures and continue the mission under NBC conditions personnel use their IPE to protect themselves from CB hazards and some nuclear effects, and this chapter provides an overview of the individual protection capabilities that are available. (Note: See Appendix A for more detailed information on individual protective equipment).

24. BACKGROUND

20. Protecting the force consists of those actions taken to prevent or mitigate hostile actions against personnel, resources, facilities, and critical information. These actions conserve the force's fighting potential so that it can be decisively applied; and sufficient equipment must be available to protect not only the uniformed force but also the essential supporting US and civilian work force. Individual and unit training for proper sizing, use of, and care for this individual and crew-served equipment is required to take full advantage of its capabilities.

25. MISSION-ORIENTED PROTECTIVE POSTURE

a. Introduction. The mission-oriented protection posture ensemble protects against NBC contamination. It consists of the overgarment, mask, hood, overboots, and protective gloves. Before personnel can protect themselves against NBC hazards, they must first know the purpose of MOPP and the capabilities of the individual protective equipment (IPE) that is available for their use during tactical operations. The types of IPE used depend on the protection required, but all fall within two major divisions: permeable and impermeable. Permeable clothing allows air and moisture to pass through the fabric. Impermeable clothing does not. An example of permeable protective clothing is the JSLIST chemical/biological (CB) protective overgarment. An example of the impermeable protective gear includes the SCALP.

b. Protective Clothing.

(1) JSLIST Chemical Protective Overgarment. The Joint Service Lightweight Integrated Suit Technology (JSLIST) chemical/biological (CB) protective overgarment was developed as part of the JSLIST program. Overtime, the JSLIST will replace its predecessor, the battle dress overgarment as stocks become available. The JSLIST provides protection against liquid, solid, and/or vapor CB agents and radioactive alpha and beta particles and is a lightweight garment, and can be laundered up to six times for personal hygiene. The JSLIST ensemble will be worn in all environments when under imminent threat of a NBC attack and after chemical operations have been initiated. Depending upon temperature and operational procedures the overgarment may be worn over the standard duty/utility uniform, personal underwear, or under/over cold weather garments. See Table VI-1 for information on the JSLIST chemical protective overgarment capabilities.

(2) Chemical Protective Undergarment (CPU). The chemical protective undergarment is worn under an approved uniform as part of an entire ensemble. The CPU provides protection against CB agents, agent vapor, liquid droplets, and radioactive alpha and beta particles. The CPU is not a standalone garment. The CPU is worn under the standard duty uniform such as the battledress uniform. The CPU is not intended to be worn under the JSLIST or BDO. The CPU is donned when personnel are directed to go from MOPP 0 to MOPP 1. When the CPU is used at MOPP 3/4, the protection afforded is equivalent to that provided by a MOPP 3/4 ensemble. See Table VI-1 for information on CPU capabilities.

(3) Battledress Overgarment (BDO). The BDO provides protection against chemical agent vapors, liquid droplets; biological agents; and radioactive alpha and beta particles. The BDO is normally worn over the duty uniform; however, in high temperature it may be worn over underwear. See Table VI-1 for information on BDO capabilities.

(4) A/P22P-9A (V) Below the Neck Protective Assembly. The A/P22P-9A (V) below the neck protective assembly provide a protective ensemble that includes undergarments, footwear covers, gloves, and a cape to protect aircrew personnel from liquid CB contamination or radioactive particles. See Appendix A for more detailed information.

(5) Wet Weather Clothing. Wet weather clothing consists of a parka and overalls. The system is designed to protect against all liquid chemical warfare agents in a cold and/or wet climate both ashore and aboard ship. The system can be worn over the chemical protective ensemble for additional protection and to prevent soaking the user. See Appendix A for more information on wet weather clothing.

(6) Chemical Protective (CP) Suit OG MK III (USN). This overgarment protects the wearer against all known chemical and biological agents which present a percutaneous hazard. The suit consists of a smock and separate pair of trousers, and is launderable for personnel hygiene purpose. This garment will be replaced Navy-wide by the JSLIST. The Mark III chemical, biological, radiological (CBR) suit protects against chemical agent vapors, aerosols, droplets of liquid, and biological agents. See Table VI-1 for information on the garments protective capabilities.

(7) CP Suit, Saratoga. Like the BDO, the SARATOGA CP suit is an air permeable, camouflage patterned overgarment. The SARATOGA protects against chemical agent vapors, aerosols, and droplets, and unknown biological agents, and is launderable for personnel hygiene purpose. See Table VI-1 for further information on the garments capabilities.

(8) CWU-66/P Aircrew Ensemble (USAF). The CWU-66/P, a one-piece flightsuit configuration and provides 24 hour protection against standard chemical and biological threats. It is less bulky than their prior ensembles and offers a reduced thermal load burden and is compatible with aircrew life support equipment.

NOTE:

- **The protective clothing previously described is permeable. If the clothing becomes contaminated, the garments are disposed of following doffing procedures. Contaminated garments can not be reused or laundered to remove contamination.**

- **Tracking days of wear for permeable protective clothing is important. Personnel can annotate the number days of wear by different methods. One way would be to annotate the number of days of wear, on a garment jacket's interior white clothing tag.**

(9) Suit, Contamination Avoidance and Liquid Protective Suite (SCALP). The SCALP is an impermeable, lightweight, inexpensive, disposable ensemble that can provide supplemental liquid protection when worn over standard chemical protective overgarments. Operationally, the SCALP will be worn by personnel who may by necessity be forced to leave collective protection under chemical attack to perform some vital maintenance or reconnaissance function. If contaminated by chemicals, the SCALP can be discarded to reduce reentry time. A secondary use of the SCALP is to protect decontamination personnel from being soaked during decontamination operation. See Appendix A for more information on the SCALP.

(10) Chemical Protective Glove Set. A glove set consists of an outer glove for protection and an inner glove for perspiration absorption. The outer gloves are made of an impermeable, black, butyl rubber. The inner gloves are made of thin, white cotton. The inner gloves can be worn on either hand. When engaged in heavy work or during cold weather, personnel should wear standard work gloves or black shells over the butyl rubber gloves to protect them from damage. See Table VI-1 for information on glove set capabilities and Appendix A for more detailed information.

(11) Green Vinyl Overshoe (GVO), Black Vinyl Overshoe (BVO), and Multipurpose Overboot (MULO). The GVO, BVO, or MULO can be used to protect the wearer against NBC agents or rain, mud, or snow (environmental effects). See Table VI-1 for information on overshoe capability; and Appendix A for more detailed information.

(12) Chemical Protective Footwear Cover (CPFC). The impermeable CPFC protects feet from CB agents and radioactive alpha and beta particles. See Table VI-1 for information on CPFC capabilities and Appendix A for more detailed information.

(13) Chemical Protective Helmet Cover. The Chemical Protective Helmet Cover is intended to provide the personnel armor-system ground troop (PASGT) Helmet with protection from chemical/biological contamination and radioactive alpha and beta particles. See Appendix A for more information on the helmet cover.

c. Other Protective Ensembles. Protective masks keep wearers from breathing air contaminated with NBC warfare agents. Masks are available in these categories: the field protective masks (M40-series; the tank and aircraft protective masks and aviators and aviation crewman masks), and special purpose masks. These field protective masks are not authorized for use during industrial chemical spills. Chemicals of that nature normally require a self-contained breathing apparatus. Further, the field protective masks referred to above would also not be effective against chemicals such as ammonia, or carbon monoxide fumes. Further, these masks are not effective in confined spaces when there is insufficient oxygen to support life. See Appendix A for descriptive information about protective masks.

(1) Protective Masks. The fielded protective masks provide users respiratory, eye, and face protection against CB agents and radioactive fallout particles. A properly worn and fitted protective mask provides a gas-tight face seal which prevents unfiltered air from reaching the wearer's respiratory system.

(2) Proper Fit. Determining proper fit for an individual's protective mask is critical. A small percentage of service personnel cannot be properly fitted with the authorized protective mask. Test systems are available to determine if service personnel have properly fitted masks (See Appendix A); and the M45 CB Mask would then be used to try and

properly fit the service member. If the service member still cannot be properly fitted with a protective mask, the individual would not be deployable to an area of operations with a CB threat. See Applicable service technical manuals/bulletin/orders for specific instructions on hard-to-fit personnel.

d. Other IPE. Other critical IPE items include, items such as medical items (i.e., nerve agent antidote, etc.), individual decontamination units, and chemical detector paper. See Appendix A for descriptions of these items.

e. Radiological Protection. See Appendix D for information on operational exposure guidance, low level radiation exposure, and depleted uranium.

26. INDIVIDUAL PROTECTION LOGISTICS CONSIDERATIONS

a. To meet sustainment requirements for operations under NBC conditions, commanders must ensure responsiveness to unit requirements. Units (or authorized storage locations) will stock specific authorized quantities for service member use as specified in service specific authorization document. For example, a forward deployed unit, such as a carrier battle group or USMC amphibious unit may require both sets of MOPP gear be immediately available based on the threat. Conversely, land forces may require that one set of IPE be carried as part of an individual field gear; and a second set of IPE be maintained by the units logistics base. This is again based on the threat. Other sustainment techniques or procedures are contained in service logistics publications.

b. Resupply of additional sets of MOPP gear into combat configured loads can be accomplished by methods such as palletizing the needed individual protective equipment (IPE). The intent of palletizing IPE is to create a “push package” that can either be broken down at an arrival location (airfield or seaport) for immediate issue to units or for further movement forward. The method of palletizing and movement is dependent on the type of unit and how they perform their mission.

c. Logistics planning and push package configurations will vary based on a unit's general deployment plan or contingency mission and the likelihood of an NBC threat in an area of operation (AO). All this would be integrated and executed through service logistics channels. These items will be moved based on certain time lines dictated by the operation plan (OPLAN) and on events that may occur during the operation.

d. Other key logistics/sustainment considerations include:

- Ensuring each service member's IPE is properly fitted and maintained.
- Anticipating resupply and replacement requirements for IPE.
- Monitoring serviceability for items such as overgarments have specific shelf-lifes (i.e., expiration date).
- Monitoring serviceability of IPE stockages. Items such as overgarment and/or mask filter canisters are issued by lot number. Periodic surveillance by the material developer can result in certain lots being reclassified for training use only.
- Tracking days of wear of overgarment (once they are removed from their bags).

27. TOXIC INDUSTRIAL MATERIALS (TIM) INDIVIDUAL PROTECTION

21. US forces frequently operate in environments in which there are toxic materials, particularly toxic industrial chemicals (TIC). A number of these chemicals could interfere in a significant manner across the range of military operations.

a. Background. Military personal protective clothing and equipment and the protective mask are designed to protect personnel from NBC agents in a combat environment, but provide only limited protection from some of the toxic industrial chemicals. Personnel equipped with standard military personal protective clothing must not remain in a TIC environment, and should seek a clean area as soon as possible.

b. Respiratory Protection. Proper selection and wearing of approved IPE can provide the required respiratory protection. This is achieved by air purification devices, such as the

M40 or MCU2A/P protective mask, or by atmosphere supplying respiratory equipment, such as the self-contained breathing apparatus (SCBA). The air purifying masks should never be worn in the presence of unidentified contaminants or in atmospheres containing less than 19.5% oxygen. This limits the use of these devices in some emergency response operations. The two types of respirators, the Self-Contained Breathing Apparatus (SCBA) and the Supplied Air Respirators (SAR) provide personnel with a source of air that creates a positive pressure in the facepiece. These respirators permit the individual to operate in low oxygen and volatile chemical atmospheres where an air-purifying respirator does not offer enough protection. The SCBA is most commonly used in emergency operations and the SAR is used when extended work times are required. These devices will provide the responder with the greatest protection against exposures to gases and vapors.

c. Individual Protection Levels. There are four levels of protection established by the US Environmental Protection Agency (EPA) in accordance with 29 Code of federal Regulation 1910.120. The Occupational Safety and Health Administration (OSHA) has also adopted these four levels. The level of skin and respiratory protection provided by the selected chemical protective ensemble determines the protection that is furnished to the responder. The levels of protection are divided into four categories (Levels A, B, C, and D) and worn according to guidelines published by OSHA and the National Fire Protection Association. Personal protective equipment places an increased level of mental and physiological stress on individuals (i.e. heat stress, respiratory resistance, etc.) which must be carefully monitored and evaluated through all phases of an operation. See Appendix A for descriptions of Levels A-D.

Table VI-1. Protective Clothing Capabilities

PROTECTIVE CLOTHING	SERVICE LIFE (OUT OF BAG)	WEAR TIME	WEARTIME ONCE CONTAMINATED	LAUNDERABLE / DECONTAMINATE

JSLIST	120d	45d	24hrs	Yes (6X)/No
BDO	22d	22d	24hrs	No/No
CPU	15d	15d	12hrs	Yes (1X)/No
SARATOGA	30d	30d	24hrs	Yes/No
CP SUIT (MK III)	30d	30d	6hrs	No/No
CHEMICAL PROTECTIVE GLOVE SET	N/A	N/A	24hrs (14/25 mil) 9hrs (7 mil)	No/Yes
GVO/BVO/MULO/ CPFC	N/A	N/A	24hrs	No/Yes

22.

Chapter VII
COLLECTIVE PROTECTION

Protection from NBC weapons is needed when it is anticipated that there is a chance of NBC contamination to either the individual or groups of personnel. There are two components of NBC Protection-individual protection and collective protection. Collective protection is that protection provided for personnel to carry out functions without being restricted by the wearing of protective clothing. Joint Pub 1-02 defines collective protection as facilities or systems equipped with air filtration devices and air locks to provide personnel with a toxic free environment for performing critical work, and obtaining rest and relief in order to sustain combat operations. Collective protection is provided through either a facility or the integral portion of equipment design whereby individuals or groups may be afforded protection. The term collective protection applies to buildings, facilities or ships modified to afford protection, pieces of equipment in their entirety or in part, or vehicles designed to provide NBC protection. Collective protection utilization is characterized by the requirement for an individual or group to execute specific actions, such as donning equipment, entering a facility or closing openings in order to derive the benefits of collective protection. Collective protection provides a safe environment for individuals to carry out tactical functions such as weapons employment, medical care, command, control, and communications, without being restricted by wearing the full set of NBC protective clothing. Paragraph 1 addresses collective protection planning considerations, and types of collective protection; and paragraphs 2-5 discuss fixed site, transportable, mobile, and naval collective protection. See Appendix B for further information preparation of a collective protection SOP; entry/exit procedures; and guidance on shelter preparation and operation.

28. Planning for Collective Protection

Collective protection is an important aspect of NBC defense. It does not replace MOPP gear; but it allows the commander to reduce MOPP levels while in a contaminated environment. Collective protection supports three primary areas that erode quickly in an NBC environment- task performance, personnel rest/relief, and sustained operations. Commanders understand that collective protection requires training of personnel in either doffing or donning procedures to enter and exit from shelters. Obtaining the benefits of collective protection can be time consuming and is executed with a degree of the risk of spread of contamination. Commanders understanding the trade-offs associated with collective protection can more accurately plan for the effective and beneficial use of collective-protection systems. To properly utilize collective protection, it must be fully integrated into the commander's overall plan Avoiding contaminated areas or displacing from contaminated terrain is desirable, but neither is always possible. It may be necessary to cross, occupy, or remain in contaminated terrain. These situations require collective protection.

a. General Planning Considerations.

(1) The commander must consider the threat, mission, tactical environment, and type of collective protection available in his planning process, and the following factors should be considered in the planning process.

- Does the function occupy a location that is considered to be a high risk target?
- How long is the facility or area likely to be subject to an NBC hazard?
- Do demands of operations require remaining in the hazard area?

(2) Regardless of the type of collective protection, the commander's planning must address supply, maintenance, gas particulate filters, and contaminated filter disposal.

- Supply. Adequate supply planning is a key element in effective use of collective-protection systems. Most systems are not supply intensive; however, operation of such systems requires a continuous resupply of consumable and expendable items. Included are items that provide a means of vulnerability reduction such as rain gear, ponchos, and plastic bags. These will keep liquid contamination away from the overgarment. Survival under NBC conditions could depend on these items. Therefore, it is not a question of merely maintaining special purpose collective-protection supplies. It is a matter of obtaining needed quantities of existing supplies. Arrange to have supplies to support extended operations of a fixed shelter kept inside the shelter if possible. Plan for the needed supplies, and stockpile them before an attack. As a minimum, these supplies should include protective clothing, expedient contamination avoidance items, decon kits, detector kits, and filters. These items will allow shelter users to conduct a protective uniform exchange. Provide adequate food and water if the shelter will operate for long periods within the contaminated area. If the shelter requires fuel, ensure it is requisitioned and stored. If the system has an external power supply, store fuel outside and away from the shelter. Plan for supplies to maintain operation of personnel in the shelter.
- Maintenance. In most cases, maintenance of collective-protection systems is minimal at organizational levels. Most systems have little or no operators' maintenance other than before-, during-, and after-operation checks and services. Operators may need to reset circuit breakers or perform system start-up procedures. At the unit level, maintenance is usually limited to troubleshooting and removal and/or replacement of major components or major subassemblies. Changing expended or contaminated filters is the most significant maintenance task. Both the gas and particulate filters require periodic replacement. (See applicable service technical publications for information on when to replace filters).
- Gas particulate filter. The useful life of a gas filter decreases as operating time and exposure increase. As the filter removes contaminants from the air, its residual capacity decreases. Long exposure to moisture also decreases

filter capacity for removing chemical agents. Gas filter life expectancy varies. It depends on the size and design of the collective-protection hardware. To determine when to replace a gas filter, the shelter attendant or another responsible person must maintain a log of the filter unit operation. Then personnel should change gas filters according to the system's technical manual. In general, new filters can withstand several chemical attacks. In most cases, missions of 48 to 72 hours can be accomplished in a contaminated environment without a filter change. Given this capacity, filter change during periodic unit maintenance is often advisable. See applicable service technical orders or technical manuals for information on defined intervals for changing of filters. Within the filter, a particulate filter collects radiological contamination and other particles from the air. Such accumulation on the filter does not decrease its filtering efficiency. It does decrease the airflow because of the increase in resistance. In most cases, this increase in resistance is very gradual. It is unusual for the airflow resistance to increase to a level that affects the flow rate appreciably. Personnel should replace this filter at the same time they replace the gas filter or when the system drops below the minimum overpressure level specified in the system's technical manual.

- Contaminated-filter disposal. Filters do not decontaminate or neutralize contamination; they merely collect and contain it. Therefore, contaminated filters are hazardous. Replacing and disposing of these filters require care to prevent a hazard to personnel or a spread of contamination. Commanders should establish detailed procedures for filter disposal during peacetime and wartime situations according to applicable technical manual/technical orders. Methods of contamination disposal such as burning creates additional

WARNING

Burning filters contaminated with chemical agents or toxins may produce a downwind vapor hazard. Warn units downwind. After burning, cover ashes with the excavated dirt and mark the site with contamination markers. Disposal of any filters after normal maintenance in peacetime also requires special handling and disposal of these as hazardous waste. This includes all masks filters and canisters and collective-protection equipment filters. Material must be transported, stored, treated, and disposed of as contamination (see warning); and would not destroy radiological contamination. The disposal methods selected (i.e., containerization, etc.) should minimize any spread of contamination.

b. Manpower.

(1) Manpower planning for collective-protection systems encompasses several factors. These include set-up and tear-down times, entry times, and shelter security. Commanders estimate these requirements based on multiple factors that may include:

- Set-Up and tear-down times. Consider set-up and tear-down times. Actual times will vary with the situation, system and degree of training. For example, it would take approximately 30 minutes to set-up the SCPE, M20, and ten minutes for tear-down of the system (for two personnel in MOPP 4).
- Entry times. Commanders should estimate entry processing times for units based on the estimated time for MOPP gear doffing.
- Shelter security. Commanders must ensure that security is maintained around any protective shelter. Security requirements depend on the tactical situation. Type and strength of a security element depend upon factors such as type of operation being conducted, location on the battlefield, and personnel available to protect the shelter. Shelters with high entry/exit require attendants. Post attendants at the shelter entrance to control entry, They should also assist in the external operations of shelter. Exact duties, during, and after an NBC attack should be outlined in the unit SOP.

(2) Other planning requirements. Other requirements such as communications are also a routine part of the commander's planning; and some of these requirements may be system specific, while others may apply to all systems. These other planning requirements may include –

- Communications. Personnel should use communication systems to communicate with others in adjacent fixed or transportable shelters or immediately outside the shelter.

- Latrines. Collective-protection shelters may include sanitary facilities. If the shelter is in a permanent structure, use existing facilities. Consider the location of existing sanitary facilities in selecting a portion of the building for an individual relief facility. Where water and sewage facilities are not available, provide covered containers or chemical toilets.
- Illumination. Have lights installed if power is available, and provide battery-operated lights for emergency use. Keep electric light usage to a minimum to prevent excessive heat buildup in the shelter. An alternative would be to use cold light sources such as chemical safety lights. Take blackout precautions where required.
- Camouflage. Construct or emplace shelter sites in areas that provide cover and/or concealment.
- Water. Have filled canteens or other water containers placed inside the shelter. Provide each occupant at least 3 quarts of drinking water for each day of anticipated occupancy. Even if piped water is available, maintain an emergency reserve of drinking water. Additional water may be needed for hygiene.
- Warning and Detection. Plan for warning and NBC detection devices in each protective shelter. These devices serve several purposes. They can detect an NBC attack and/or determine if the shelter interior is contaminated. These devices also monitor personnel going through decon In addition, these devices can warn of shelter system failure.

c. Types of Collective Protection. To support collective protection planning, there are different types of collective protection. They are categorized according to their tactical application, interface with tactical equipment, and mobility. The categories are: fixed site, transportable and mobile. Fixed collective protection include facilities not intended to be moved and are either hardened, semi-hardened or unhardened. Transportable shelters are facilities which can be sited where needed, can be moved as required, and are generally unhardened. Mobile collective protection are those facilities either armored, or soft skinned, may or may not be capable of being used on the move, and may not have integrated airlocks or contamination control areas (CCA).

29. Fixed Site Collective Protection

23. Fixed site collective protection is generally found at those locations where permanent base operations exist. At those fixed sites, such as air operations bases, critical functions such as command and control must be maintained. Thus, fixed site collective protection occupies a critical role in the planning process and in responding to an NBC attack. (See references such as Field Manual [FM] 3-11.34, Marine Corps Warfighting Publication [MCWP] 3.37.5; Navy Tactics, Techniques, and Procedures [NTTP] 3.11.3; and Air Force Tactics, Techniques, and Procedures [AFTTP] Interim [I] 3-2.33, for further details on collective protection for fixed sites).

a. Background.

(1) Fixed site collective protection is categorized as active or passive, according to the type facility and equipment available. Active protection requires a high efficiency air filtration unit and a tightly constructed building or shelter. This system provides the highest levels of NBC protection for long periods. (Figure VII-1 depicts a typical basic collective protection shelter design, using overpressure and air locks). With passive applications, the building or shelter acts as a protective barrier by limiting the exchange of air between indoors and outdoors. The lesser amount of air that passes (the exchange rate), the greater the protection afforded.

b. Fixed Site Collective Protection Planning Considerations.

(1) Commanders should consider a number of factors in planning for the installation or upgrade of fixed site collective protection facilities. For example, collective protection systems employ a filter unit capable of removing agents from the air being circulated

through the filter, and as a general rule also employ some type of temperature management system for comfort of the personnel in the shelter

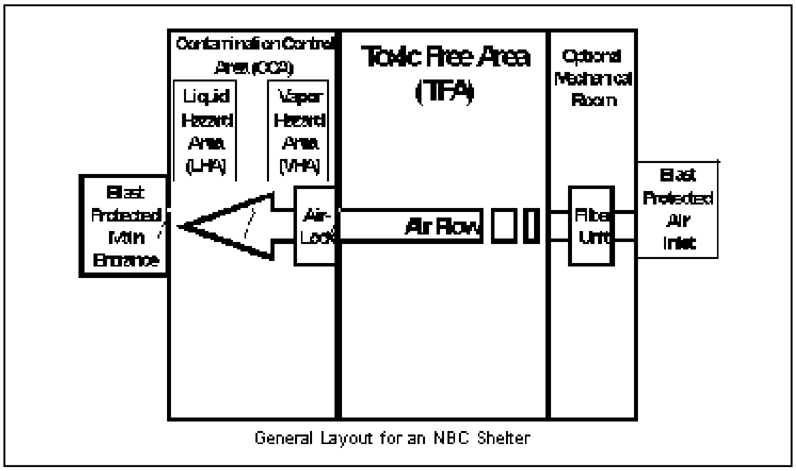


Figure VII-1. General Layout for an NBC Shelter

(2) A building or other facility employed as a chemical shelter can be likened to a leaky boat. The safety afforded is dependent on the rate of leaks, in this case, leaks of air. The rate of leaking in relation to its volume is termed the air exchange rate, which is the rate of uncontrolled exchange of air between the interior and the outside. This air exchange rate determines how rapidly airborne contaminants infiltrate the structure from the outside, and how rapidly they are purged from the building once the outside air is no longer contaminated.

(3) Air exchange rates vary, not only from structure to structure, but also for a given structure over time. Some of the variables which influence air exchange rates are:

- Wind velocity and direction. The air exchange rate increases as wind speed increase. Wind produces a pressure difference between the outside and inside, causing air to infiltrate through the windward and exfiltrate on the opposite walls.
- Inside-outside temperature differences. As the temperature difference increases, inside and outside, the air exchange rate increases. This difference

is manifested in pressure differences on the walls and doors according to height, which increases the "stack effect" of agent infiltration.

- Ductwork systems. Crevices around heating, ventilation and air conditioning (HVAC) ductwork and openings provides a major pathway for infiltration, along with increases in air exchange rates when the system is operating.
- Combustion. The combustion process of heating a structure results in increases in air exchange, from the outside into the structure.
- Seasonal variations. Air exchange rates are highest in winter and lowest in summer as a result of contraction and expansion of building materials due to moisture and temperature content changes.
- Upstairs/downstairs. Air exchange rates can be higher downstairs than upstairs.
- Room variations. Air exchange rates vary among rooms due to structure design, construction materials, orientation to the wind and location to outside walls.

(4) Chemical warfare experiments demonstrated that over time, the dosage inside a building approaches the dosage outside if there is no substantial loss of agent to materials absorption. A closed building dampens the rapid fluctuations in concentration caused by the random variability inherent in atmospheric diffusion, protecting occupants from exposure to high peak concentrations. If the shelter's exchange rate remains constant, it will take longer to purge the contaminant after a cloud has passed than it took for contaminant to enter the building, and at some point during or after cloud passage, the concentration inside may exceed the contamination level outside.

c. Assessing Facility Suitability for Collective Protection. In general, most facilities can be used for collective protection. In some cases, extensive modifications will be required. Prior to the installation of systems, consideration must be given to the following:

(1) Tightness of facilities. The suitability of a building or shelter for positive-pressure collective protection is determined by the leakage rate of the building. Ideally, the flow rate

of filtered outside air to achieve a required overpressure should be no more than that needed for health and comfort of the occupants (i.e., 20 cubic feet per minute (CFM) per person). Building tightness can vary greatly with the condition of the building and design defects such as unsealed construction openings, drop ceilings and false walls. Focus should be on reducing the air leakage from a building.

(2) Methods of Tightening the Building. When a collectively protected building is pressurized, its protection envelope must be tightened by closing all intentional openings (e.g., outside air vents, exhaust vents, windows, and doors). Other openings (e.g., cracks, crevices, joints, and penetrations for pipes and cables) must be closed to the maximum extent feasible. Caulking and weather stripping provide other means to tighten the structure.

d. Protective Entrances. A protective entrance provides an interface between the contaminated environment and the protected enclosure. It enables shelter users to remove contaminated clothing and perform decontamination procedures, providing a relatively clean environment before entry into the shelter. See Appendix B for information on specific types of protective entrances.

e. Shelter Equipment. Generally, significant efforts would be required to integrate filter units with heating, ventilation and air conditioning (HVAC) systems. The least costly approach for hazard reduction is often to shut off the HVAC system and block the supply and return vents to the protected area when the system is pressurized. Such measures would likely require alternate heating or cooling methods. See Appendix B for information on shelter equipment that could be used to establish protective shelters.

f. Shelter Equipment Characteristics.

(1) Overpressure levels. The minimum overpressure recommended for stationary collective protection shelters is 0.1 inches water gauge (iwg) or 25 Pascal. This standard is

based on preventing air infiltration at ambient wind speeds greater than 15 mph. At 15 mph, the wind reduces the concentration and dosage of mustard evaporating from the ground by about 98 percent, compared with calm conditions. When preparing buildings and conducting test measurements, it is advisable to provide for a higher pressurization (0.2 iwg) to ensure 0.1 iwg is still achieved over time, as sealing measures and building structures may deteriorate.

(2) Contamination control area (CCA). The CCA and airlock allow people to transition from individual protection to collective protection without introducing contaminants into the TFA. Personnel remove contaminated outer garments in the CCA before entering the airlock. Permanent or interior CCAs have a filtered airflow rate sufficient to suppress vapor concentrations from contaminated garments worn into the CCA. Open-air CCAs have high air flow rates, but the air may not be clean, filtered air. Figure VII-2 shows a tent used as a CCA and attached to the airlock. Vapor sorption or the adherence of agent vapors to surrounding materials/objects is the primary problem in most CCA. See appendix B for procedures to transfer into a toxic free area.

(3) Integration of NBC detectors. The agent vapors in the open-air CCA can actually adhere to the individual after doffing the overgarment and before entry into the airlock. There are four options for detecting and dealing with this problem:

- Halt entry processing if vapor hazards are detected.
- Use a chemical detectors screen/halt entry candidates with desorbing vapor.
- Require removal of all garments if internal or exterior monitors detect vapor and issue new or temporary garments inside the TFA.
- Combine showers with the previous option.

> **NOTE**
>
> Using M8 paper to check for contamination prior to shelter entry is undesirable as a pre-entry screening tool unless driven by operational requirements

g. Classes of Fixed Site Collective Protection. For fixed site collective protection facilities, classes of protection (Class I-III) are defined according to the degree of protection provided and the extent of the expected hazard. In addition to criteria for classification standards, the expected threat determines whether a protective system should be designed to operate continuously or on a standby basis.

- Class I – pressurized shelters.
- Class II – intermediate.
- Class III – passive.

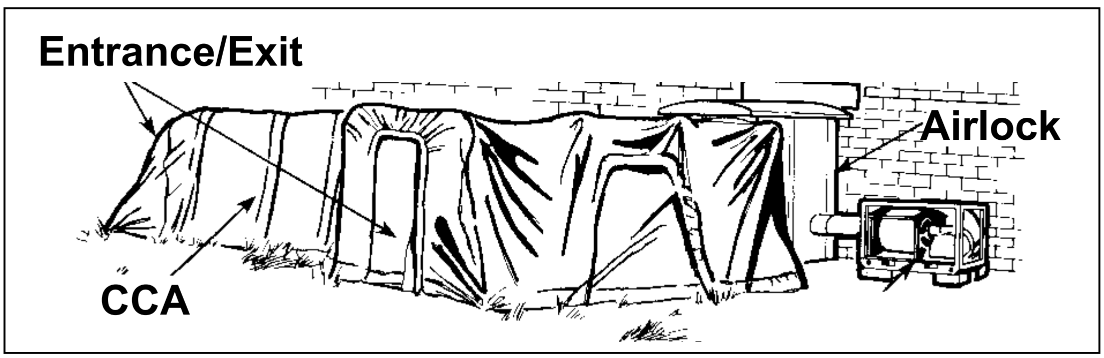


Figure VII-2 Tent used as Contamination Control Area (CCA)

h. Sheltering in Place.

(1) Background. Sheltering in place reduces but does not eliminate the risk of exposure to chemical or biological agents. Sheltering in is an alternative to evacuation, Sheltering in place has a role in the commander's planning process, because evacuation for some groups may not be feasible or possible. Adequate pressurized shelters may not be available. Likewise, the amount of forewarning of impending agent contamination may not be adequate for evacuation.

(2) Shelter in place concept. The concept of sheltering in place is to go indoors, close all openings to the outside and attempt to restrict the exchange of air from the outside to the inside. These preparations should be accomplished before the arrival of a contaminant cloud. Given adequate warning, additional measures should be taken such as sealing openings with plastic sheeting and tape. Use of IPE is still required to minimize the risk of exposure; however, not all personnel in the downwind hazard area (i.e., civilian) may have the required IPE. The amount of protection afforded by sheltering in place varies with the air exchange factors previously discussed. Based on the levels of sealing, there are four levels of sheltering in place:

- Normal sheltering whereby all windows and doors are closed and all HVAC equipment is turned off.
- Expedient sheltering, where simple, rapid measures are taken to enhance the protection. Such measures are taping doors, windows, electrical outlets, and placing rolled wet towels at the base of doors.
- Enhanced sheltering involves caulking joints, applying weather strips and storm windows and other modifications to reduce air infiltration.
- Pressurized sheltering involves use of gas-particulate filter blowers to increase the pressure inside the structure to exceed that of outside pressure, and provide filtered air.

(3) Expedient Sealing Measures. The procedures of expedient sheltering are based on an assumption that there are techniques that can be applied with little or no training and with commonly available materials to reduce the air exchange rate. Applying room selection and sealing to one room can also provide a higher protection level by reduction of the air exchange rate. Testing has indicated that a room sealed with plastic sheeting and tape provided 10 times greater protection than sealing the entire house.

(4) Implementation. To implement sheltering in place requires planning to –

- Ensure occupants know how to take protective measures.

- Determine that a release has occurred.
- Determine areas that may be affected by the release.
- Communicate a timely warning to all people in the affected areas.
- Communicate the appropriate time to vacate in-place shelters.

(5) Shelter in place instructions. Basic guidance for sheltering in place include three core steps: close windows and doors, turn off HVAC, stay in doors and standby for further instructions. Table VII-1 provides examples of measures that can be used for sheltering in place.

Table VII-1. Sheltering Instructions

SHELTERING INSTRUCTIONS
• Measures Common To All: ⇒ Close doors and windows. ⇒ Turn off fans, heating and air conditioning. ⇒ Stay in room,await instructions on when to evacuate. • Sealing Measures. ⇒ Place wet towels under doors. ⇒ Close fireplace/heating register dampers. ⇒ Tape plastic over windows, doors, outlets, cracks and heat registers. ⇒ Seal bathrooms. • Room Selection. ⇒ Use above ground room, not basements. ⇒ Interior room, few or no windows, no plumbing fixtures or air conditioners. ⇒ Use room away from most logical source. • Complementary Measures. ⇒ Cover mouth and nose with damp cloth. ⇒ Close bath door, turn shower on to wash air. ⇒ Don protective clothing to exit shelter. • Minimizing Leakage. ⇒ Minimize use of elevators. ⇒ Ensure all ventilation systems set to “recirculate”.

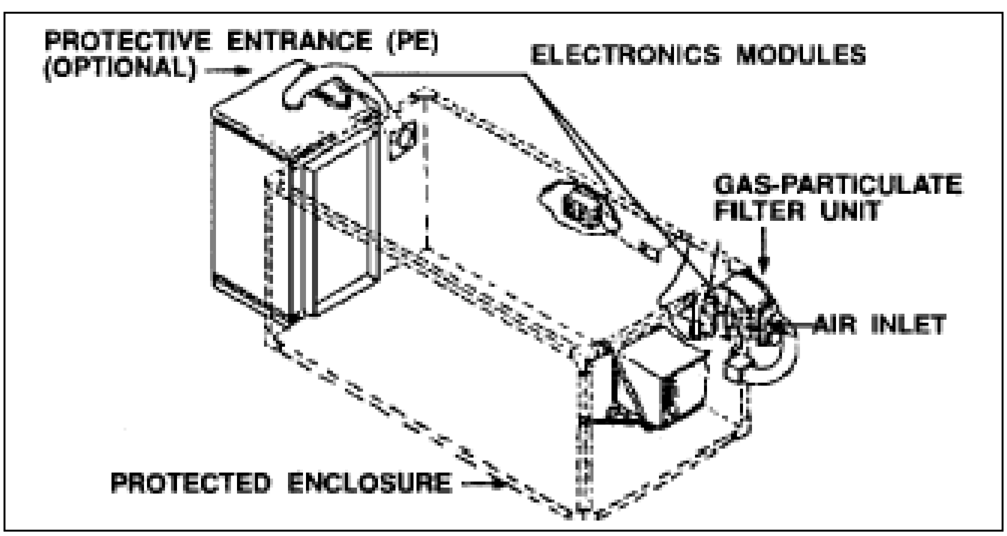
- Measures After Cloud Has Passed.
  - ⇒ At "All Clear", open doors and windows to ventilate building.
- Other Measures.
  - ⇒ Keep phone lines open.
  - ⇒ Have kit of essentials.
  - ⇒ If danger of explosion, stay clear of windows.

30. Transportable Collective Protection

24. Transportable collective protection provides the commander another means of providing a clean air shelter for use against chemical, biological and radiological particles. Transportable collective protection systems employ the principle of pressurized, purified air to provide a contamination free environment in which to work. The system does not protect against gamma radiation or neutrons. The air pressure precludes leakage of contaminated air into the enclosure. Personnel enter and exit through a protective entrance. The protective entrance is an air lock which prevents contamination from entering the enclosure. Transportable collective protection can be used for rest and relief, command and control, light maintenance and for medical treatment facilities.

a.Modular Collective Protection Equipment.

(1) Modular (transportable) collective protection. Modular collective protection is that collective protection which provides commanders the flexibility to move collective protection to sites where it is needed. The system includes an array of equipment, consisting of gas



particulate filter units (GFPUs), protective entrances and various installation kits. Figure VII-3 show a typical modular collective protection system.

Figure VII-3. Modular Collective Protection Equipment

(2) Modules can be grouped to provide space as dictated by the tactical situation. Figure VII-4 depicts examples of modular application to systems such as wheel or tracked vehicles, expandable vans or a series of vans that are linked.

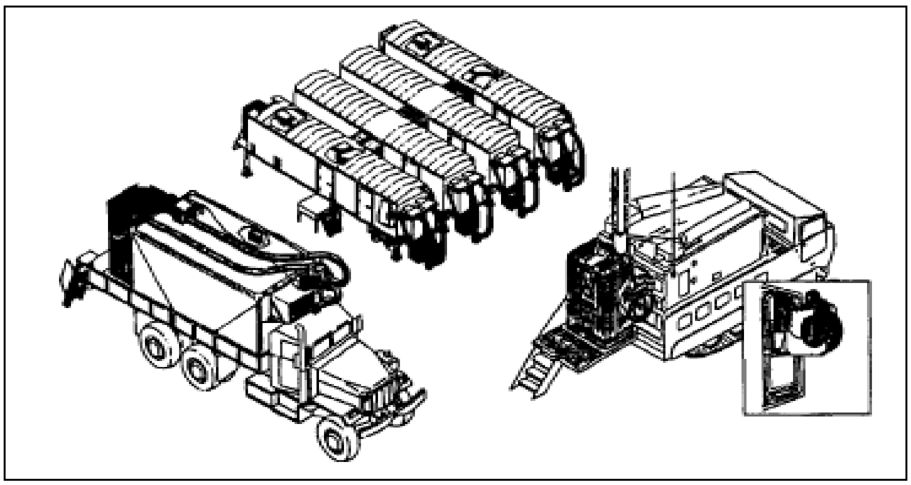


Figure VII-4. Examples of Modular Collective Protection Application

b. Transportable Systems. The commander decides whether to use transportable collective-protection assets. The basis for the decision is the determination that tasks such as C^2 relief from MOPP gear is mission essential. When a collective-protection system is used for rest and relief, the commander must ensure coordination of MOPP-gear resupply and security. Shelters used for personnel relief require a great number of entry and exits. In addition, personnel must continuously monitor shelter operations. This monitoring ensures the system functions properly and that no contaminants have entered the system.

(1) M20A1 Simplified Collective-Protection (SCPE). The M20A1 is an updated version of the M20. Both systems are still in the inventory. The SCPE provides a clean-air

shelter for use against chemical and biological warfare agents and radioactive particles (Figure VII-5). It is lightweight and mobile, and it allows unit commanders to convert existing structures into protected command, control, and operations centers. The SCPE can be used as a temporary rest and relief shelter (for example, as a break area for personnel working in heavy maintenance and supply operations) or as a command and control center. It provides a contamination-free environment in which 10 personnel can work, eat, or rest without the encumbrance of the IPE. The M20A1 consists of a large, cylindrical shaped liner designed to be inflated inside a room or building. A support kit contains a motor blower for inflation and flexible air ducts to direct the air. The M20A1 can be erected without the liner using only the protective entrance and blower compartment. A bib section is available that will fit between the protective entrance and the frame of any door, and when taped down, seals the entrance from outside contamination.

Figure VII-5. M20A1 Simplified Collective Protection (SCPE)

(2) M28 SCPE. The M28 SCPE is a highly transportable collective protection system used in conjunction with the Tent Extendable Modular Personnel (TEMPER). The modular system consists of agent resistant liner sections, protective entrance, tunnel airlock for litter patients, hermetically sealed NBC filter canister, recirculation filter, and a support kit containing a motor blower and ancillary equipment. These components are available separately as spare parts or packaged together into six basic M28 configurations. Figure VII-6 depicts the M28 installed in a TEMPER Tent.

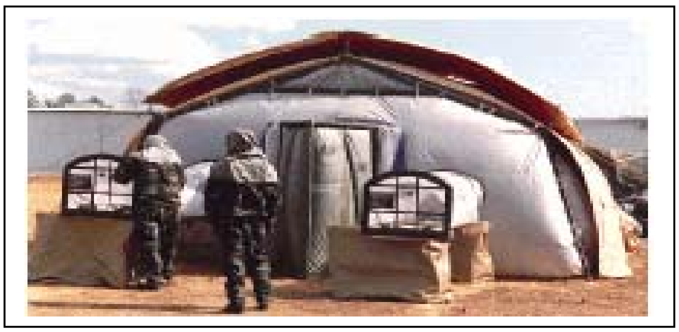


Figure VII-6. M28 Simplified Collective Protection Equipment (CPE)

(3) Tent Extendable Modular Personnel (TEMPER). This system provides the commander with the flexibility of tailoring collective protection to the tactical situation. This modular shelter is available in sections that can be assembled to provide space as required. The M28 SCPE can be used to provide the NBC protection required. Figure VII-7 is an example of a TEMPER installation, with a CCA. (Note: The TEMPER can cause false positive readings with the ICAM, especially in newly issued TEMPER shelters).

Figure VII-7. Typical TEMPER Installation with CCA

(4) Chemically Protected Deployable Medical Systems (CPDEPMEDS). The CP DEPMEDS is a deployable hospital consisting of a complex of TEMPER tents, passageways and expandable shelters. The M28 can be used in sufficient numbers to provide collective protection to the facility. (see Figure VII-8).

Figure VII-8. Chemically Protected Deployable Medical System (CP DEPMEDS)

(5) The Chemically and Biologically Protected Shelter (CBPS). The CBPS provides an environmentally controlled and toxic free work area. The shelter can serve as a battalion aid station for medical treatment in a contaminated environment. The shelter is transported on a HMMWV. It has a 300 square foot tent supported by airbeams inflated

with air to form a semi-circular shape, that can be rolled and transported. The vehicle provides power to support the system's operation. (see Figure VII-9).

Figure VII-9. Chemically and Biologically Protected Shelter (CBPS)

31. MOBILE COLLECTIVE PROTECTION

25. Mobile Collective Protection Equipment (CPE) provides protection to a group of individuals under NBC conditions. Table VII-2 depicts the types of mobile collective protection systems found on vehicles and aircraft. Personnel in mobile CP are protected by a collective-protection and may operate at the reduced MOPP levels shown in Table VI-3. Those personnel who are not protected by collective protection when an attack occurs should activate the collective-protection system and assume MOPP4. They must remain at that level until the shelter interior is purged. Required purge times vary with the interior shelter volume and the airflow. Check specific technical publications for each system. When the required purge time passes, personnel should follow unmasking procedures. When the all-clear signal is given, personnel may resume the modified MOPP level shown in Table VI-3.

a. Mobile Collective Protection Systems (Air/Land).

(1) Background. With air and land mobile collective protection systems, there are four basic types of collective protection. The types are classified according to the degree of protection they provide and the manner in which they are integrated into the host system. They include: ventilated facepiece systems, overpressure, hybrid, and total systems.

(2) Ventilated-facepiece systems. Ventilated-facepiece systems supply filtered air to the protective mask canisters. The systems are designed to connect to GPFU and are rated by their airflow capacity, in cubic feet per minute. The components of these systems are similar. The filtered, pressurized air supplied to individuals extends the MOPP gear's capabilities. It reduces breathing resistance through masks, and it aids in sweat evaporation. In addition, it can provide warm air to facepieces in cold weather. Figure VII-10 depicts the ventilated facepiece concept.

Table VII-2. Types of Collective Protection Systems

SYSTEM	DESCRIPTION	CONDITIONS JUSTIFYING THE REQUIREMENT	EXAMPLE SYSTEMS
Ventilated Facepiece	Series of individual respiratory systems for masks serviced by a common filter	• Clean Working area subject to inadvertent entry of contamination. • High work rate reduced breathing system. • Frequent entry and exit movements. • Brief inside occupation.	• Infantry Fighting Vehicles. • Self Propelled Howitzers.
Overpressure	A Collective NBC filter and overpressure and ventilated facepiece systems	• Critical manual dexterity skills. • Limited entry/exit movements. • Lengthy inside occupation.	• Air defense. • Communications. • Medical. • Patient evacuation vehicles • Maintenance and supply sites. • Rest and relief.

Table VII-2. Types of Collective Protection Systems (Continued)

SYSTEM	DESCRIPTION	CONDITIONS JUSTIFYING THE REQUIREMENT	EXAMPLE SYSTEMS
HYBRID	Combination of overpressure and ventilated facepiece systems.	• Flexibility. • Lengthy inside occupation. • Emergency entry/exit movements.	• Armored Fighting Vehicles (Tanks) • Helicopters. • Air Defense. • Multiple Launcher Rocket Systems.
TOTAL	Hybrid or overpressure plus an environmental control system. Other categories may also incorporate environmental control. For example, ventilated facepiece and microclimatic cooling.	• Same as hybrid. • Extreme climates.	• Same as hybrid

(3) Overpressure System. An overpressure system is an enclosure of pressurized purified air. Gas and particulate filters remove any NBC contamination from the air. The air pressure precludes leakage of contaminated air into the enclosure. Figure VII-11 depicts a typical vehicle with an overpressure system, allowing IPE-free operations.

Table VII-3. Collective Protection MOPP Levels

PERSONNEL IN COLLECTIVE PROTECTION	
Ventilated Facepiece	**Overpressure**
Assume MOPP Zero.	Assume MOPP Zero Overpressure off.
Assume MOPP 1	Assume MOPP 1. Overpressure on.
Assume MOPP 2.	Assume MOPP zero or MOPP 1. Overpressure on. Entry and exit procedures required if an attack occurs.
Assume MOPP 3 or MOPP 4*. When mounted connect ventilated facepiece to mask.	Maintain MOPP zero or MOPP 1 unless interior is contaminated. Overpressure on. Entry/exit procedures required if an attack occurs.

Table VII-3. Collective Protection MOPP Levels (Continued)

PERSONNEL IN COLLECTIVE PROTECTION	
Ventilated Facepiece	**Overpressure**
Assume MOPP 3 or MOPP 4*. When mounted connect ventilated facepiece to mask.	Maintain MOPP zero or MOPP 1 unless interior is contaminated. Overpressure on. Entry/exit procedures required if an attack occurs.
* During an engagement the commander may allow personnel protected for liquid agents to operate temporarily without protective gloves. This option could slightly increase the ppotential for casualties. ** MOPP gear could include JSLIST. If JSLIST is worn at the appropriate MOPP level, pull hood over head and secure mask; close slide fastener completely and secure hook-and-pile fastener type up to top of slide fastener. Place edge of hood around edge of mask and secure hook-and-fastener type.	

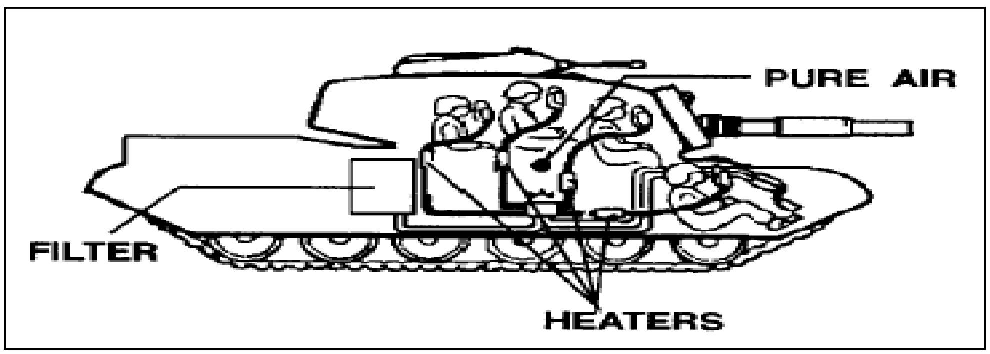


Figure VII-10. Concept of Ventilated Face-Piece

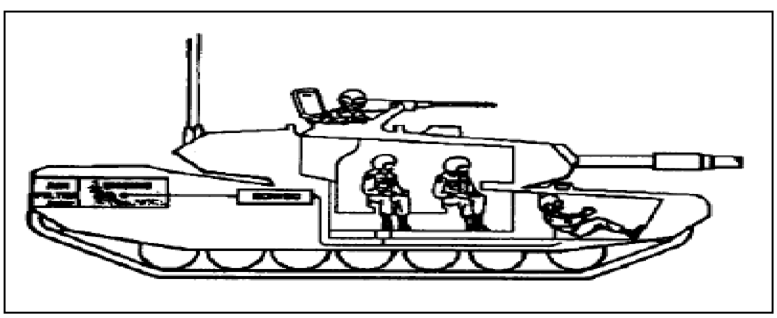


Figure VII-11. Vehicle with Overpressure System

(4) Hybrid system. Hybrid systems combines positive pressure and the ventilated face mask inside the enclosure with the option of using positive pressure, the ventilated face mask, or both. Depending on the system installed, the system can be used during

closed-hatch, positive pressure operations or open-hatch, ventilated face mask operations. During open-hatch operations, the positive pressure reduces the amount of vapor contamination that enters. If contamination enters, the system helps purge the interior of toxic vapors. Figure VII-12 depicts a vehicle with the hybrid system.

Figure VII-12. Vehicles and Hybrid System

(5) Total system. A total system combines overpressure and environmental control to provide a pressurized and cooled NBC protected environment not dependent on individual protection. Cooling reduces heat stress for personnel operating in extremely hot and/or humid conditions. MOPP gear significantly increases the potential for heat stress, making cooling systems desirable. Crew compartment cooling provides air conditioning to the compartment, and individual cooling proves effective when used while MOPP gear is worn. The choice of cooling system depends on the vehicle type and primary mission. The overpressure and cooling systems reduces heat-stress casualties; however, they increase the logistical burden, primarily because of maintenance. Vehicles such as the MlA1 Abrams main battle tank (Figure VII-13) and the Marine amphibious vehicle, may have

overpressure systems. In addition to the overpressure system, the crews are provided a ventilated facepiece. During closed-hatch operations the system provides positive pressure and crew cooling. During open-hatch operations the system will provide cool, filtered air to the ventilated facepiece and cooling vest. Before initiating open-hatch operations, personnel must be masked before exiting the vehicle to prevent any possibility of chemical agent exposure. Additionally, during open hatch operations, the system provides modest overpressure that significantly reduces the amount of contamination infiltrating the crew compartment. Consequently, the time required to purge contamination is reduced.

Figure VII-13. M1A1 Main Battle Tank (MBT) with Collective Protective System

b. Risk assessment. Commanders must carefully plan for both the benefits of collective protection and for the additional restrictions and limitations placed on the individuals and crews by its use. Depending on the type of collective protection, individuals and crews can work longer and more comfortably while in collective protection, thus increasing the efficiency and combat capability of the individuals or crews. The commander must, however, understand the restrictions imposed by employing collective protection, and the loss of system efficiency and capability due to the time and procedures required to employ the collective protection. Additionally, the restrictions on personnel dexterity, vision, task performance, and time and effort required to enter and exit from a system in a contaminated environment must be considered. Table VII-4 shows example advantages and disadvantages of various mobile collective protection.

Table VII-4. Advantages and Disadvantages of Collective Protection Systems

SYSTEM	ADVANTAGES	DISADVANTAGES
Ventilated-Facepiece	• Reduces stress from breathing resistance. • Reduces eye-lens fogging. • Allows open hatch operations. • Increases protection level of the mask.	• Requires that users use MOPP gear. • Is attached by umbillical cord. • Does not protect vehicle interior from vapor contamination.
Overpressure	• Allows reduction of MOPP level. • Reduces vapor concentration inside the vehicle. • Can provide relief from continuous wear of MOPP gear.	• Requires close-mode operations for safe unmasking. • Requires entry and exit procedures. • Increases logistical support requirements.
Hybrid Overpressure Mode	• Allows reduction of MOPP level. • Reduces vapor concentration inside the vehicle. • Can provide relief from continuous wear of MOPP gear.	• Requires close-mode operations for safe unmasking. • Requires entry and exit procedures. • Increases logistical support requirements.
Hybrid (Ventilated-Facepiece Mode)	• Reduces stress from breathing resistance. • Reduces eye-lens fogging. • Allows open hatch operations. • Increases protection level of the mask.	• Requires that users use MOPP gear. • Does not protect vehicle interior from vapor contamination. • Is attached by umbilical cord.
Hybrid (Ventilated-Facepiece Mode)	• Reduces stress from breathing resistance. • Reduces eye-lens fogging. • Allows open hatch operations. • Increases protection level of the mask.	• Requires that users use MOPP gear. • Does not protect vehicle interior from vapor contamination. • Is attached by umbilical cord.
ToTAL	• Same as Hybrid System. • Reduces heat-stress casualties.	• Same as Hybrid System. • Increases logistical burden, primarily maintenance.

32. NAVY COLLECTIVE PROTECTION SYSTEMS (SURFACE SHIP)

a. Surface Ships. Collective protection is the use of shipboard equipment and operations to provide a toxic free environment to permit personnel to carry out tactical functions without donning IPE. Collective protection aboard surface vessels is dependent on the type of vessel. In general, those vessels in which some type of collective protection is installed will have either portions of the vessel or the entire vessel adapted for collective protection. (See Figure VII-14).

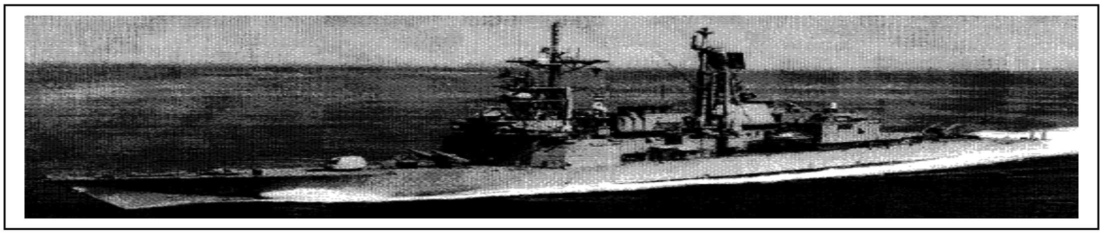


Figure VII-14. Typical Surface Ship with Collective Protection

b. Surface Ship Ventilation System. All ships have ventilation systems that provide fresh air throughout the vessel. Ship ventilation systems are effective in stopping large particles, but are ineffective in stopping aerosol and vapor contaminants. The entry of these contaminants can be minimized by shutting as many closures as possible. One countermeasure, Circle William, which is the closure of all outside openings, is set to prevent contaminants from entering the compartments. Even when countermeasures have been taken, it is likely that some vapor contaminants will enter the interior of the ship. Ventilation systems are effective in removing vapor contaminants through exchanging the air within compartments. This process, purging, is quite effective. As an example, one change of air will remove one-half of the contaminants. Six changes of air will remove almost all contaminants. For those vessels that have collective protection systems, all or part of the vessel will contain the components necessary to provide the collective protection. The system will include the areas that have overpressure capability, fans and filters, airlocks and decontamination stations. Those components are depicted in Figure VII-15.

c. Shipboard Collective Protection System. The collective protection system (CPS) aboard many ships is an installed ventilation system which sends filtered air to designated zones for protection against toxic agents. The zones are contiguous spaces which share common boundaries such as hull frames, bulkheads, decks and accesses. Airlocks, pressure locks and decontamination stations maintain the integrity of the toxic free environment, and allow personnel to enter and exit the collective zones. CPS can provide total or limited protection. Total protection provides a IPE free environment. Ships with limited protection provides protection from liquid chemical agents, however, a mask must be worn since protection from vapors is not provided. Following a chemical attack, ships with limited protection must move to a contamination free area for purging of the compartments. NWP 3-20.31, Rev A, Surface Ship Survivability provides details on ship collective protection employment. The specifics of a particular ships' collective protection system and its operation are contained in the ship's chemical, biological, and radiological (CBR) Defense Bill.

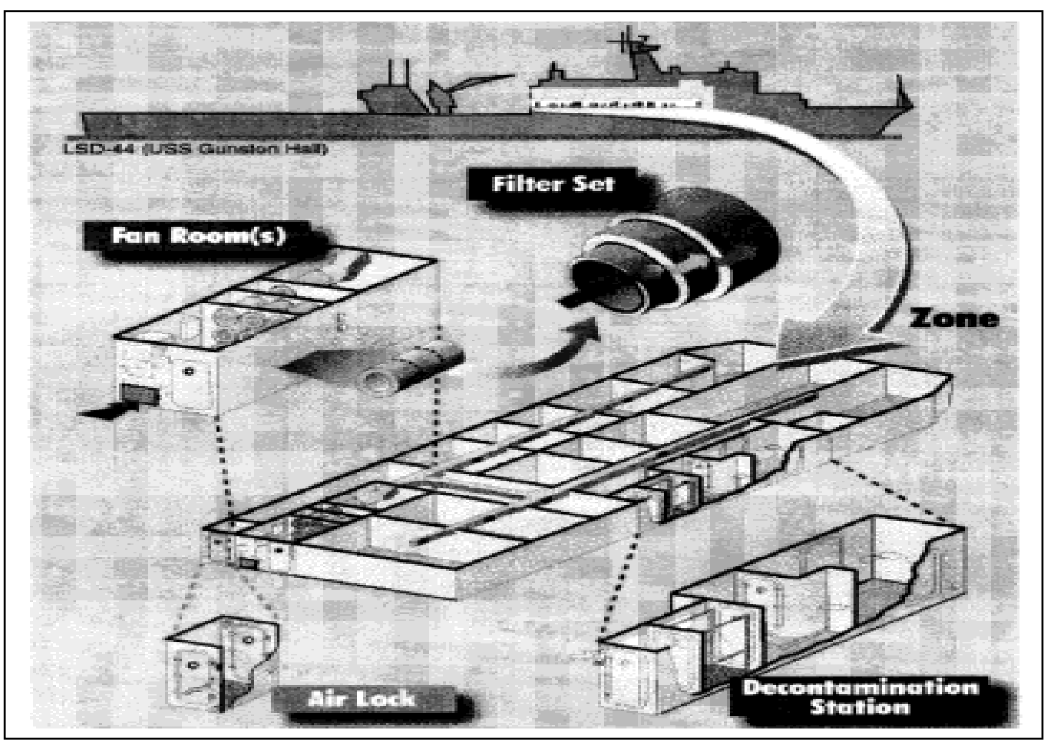


Figure VII-15. Layout of a Ship's Collective Protection System

Appendix AAppendix A

NBC PROTECTION EQUIPMENT

26. As stated in Chapter I the armed forces of the United States must be prepared to conduct prompt, sustained, and decisive combat operations in NBC environments. The armed forces of the United States has the finest NBC protective equipment in the world. Appendix A provides additional information that supplements earlier descriptions of IPE and masks. Appendix A describes items such as protective clothing, masks, TIM protective equipment, decontamination, detection, medical and other related items (i.e., chemical agent monitors/alarms, and radiac equipment/dosimeters).

33. PROTECTIVE CLOTHING

a. Joint Service Lightweight Integrated Suit Technology (JSLIST). The JSLIST overgarment (see Figure A-1) has a service life of 120 days of which 45 days is the maximum weartime. It can laundered up to six times for personnel hygiene purposes, and provides 24 hours of protection against liquid, solid, and/or vapor CB attacks. It also provides protection against radioactive alpha and beta particles. Weartime for the JSLIST begins when it is removed from its sealed vapor-barrier bag; and stops when the garment is sealed back into in its vapor-barrier bag. Donning of the JSLIST (regardless of the time) equates to a day of wear. To ensure serviceability, personnel conduct operator or shipboard preventive maintenance checks and services for JSLIST in accordance with US Army TM 10-8415-220-10; USAF Technical Order 14P3-1-141; USMC TM 8415-13-; and USN 55300-AP-MMO-010. Damaged JSLIST chemical protective ensemble items may be retained only for training purposes. CB protection provided by the JSLIST chemical protective overgarment is dangerously degraded if the area where clothing is wet through the inner liner lining with petroleum products, perspiration, urine, and feces, and many common insect repellents. If the overgarment becomes wet through the inner lining with any of these materials, replace it as soon as possible. The primary users include each service component (USA, USMC, USAF, USN).

Figure A-1. Joint Service Lightweight Integrated Suit Technology (JSLIST) Overgarment

b. Chemical Protective Undergarment (CPU) (see Figure A-2). The CPU is two piece undergarment consisting of a form fitting undershirt and trousers. The CPU is not removed from its bag until it is ready for use. When the CPU is removed from its vapor-barrier bag, its protective qualities last for a minimum of 15 days. The weartime for the CPU begins when it is removed from the vapor-barrier bag and stops when the CPU is sealed back into the vapor-barrier bag. If the original bag is not available, use a replacement bag that, as a minimum, is water resistant or water repellent. The CPU is launderable once for personnel hygiene purposes during its 15 day use. It provides protection from CB agents (solid, liquid, vapor) for up to a 12 hour period after attack. The CPU also protects against radioactive alpha and beta particles. When worn under a duty uniform, the CPU has also exhibited enhanced flash fire protection capabilities. The CPU is generally used by special operations forces, explosive ordnance disposal (EOD), Technical Escort, and depot personnel.

Figure A-2. Chemical Protective Undergarment

c. Battledress Overgarment (BDO) (See Figure A-3). The BDO is a camouflage colored, woodland or desert, expendable two-piece overgarment consisting of one coat and one pair of trousers. The BDO presently comes sealed in a vapor-barrier bag that protects against rain, moisture, and sunlight. The BDO is water resistant, but not waterproof and is normally worn as an outer garment. In extreme cold weather environments, the BDO should be worn between layer 2 (bib overall, cold weather shirt, and trouser liner) and layer 3 (coat liner and field trousers) of the Extended Cold Weather Clothing System (ECWCS). In extreme cold weather environments, the BDO is sized to wear over arctic/extreme cold weather environmental clothing; however, mission requirements may dictate that the BDO be worn under arctic clothing. When the BDO is removed from its vapor-barrier bag and worn, the BDO may be worn up to 22 days, wear time can be increased to 30 days, with slight increases in risk, at the discretion of the commander. Weartime for the BDO begins when it is removed from its sealed vapor-barrier bag, and stops when the BDO is sealed back in its vapor-barrier bag. If the original vapor-barrier bag is not available, return the BDO to a similar material bag, and seal with common duct tape, Donning of the BDO regardless of the time equates to a day of wear. The BDO provides a minimum of 24 hours of protection against exposure to CB agents (solid, liquid, vapor), and radioactive alpha and beta particle. While the BDO is not designed to be decontaminated or reimpregnated for reuse, the use of the M291/M295 kits on contaminated ensembles within 15 minutes of the time of exposure to liquid chemical agents will essentially maintain the BDO's full capabilities. The BDO becomes unserviceable if it is ripped, torn, fastener broken or missing, or petroleum, oils, or lubricants are spilled or splashed on the garment. Users conduct PMCS for the BDO according to applicable service technical directive. The BDO is being replaced by the JSLIST overgarment. The BDO's primary users include – USA, USN, USMC, and USAF.

Figure A-3. Battledress Overgarment (BDO)

NOTE: If the original vapor barrier bag for clothing such as the JSLIST overgarment, CPU, or BDO is not available, use a replacement bag that, as a minimum, is water resistant or water repellant.

d. A/P22P-9A (V) Below the Neck Protective Assembly (see Figure A-4). The A/P22P-9A (V) below the neck protective assembly (Figure 1-5) consists of the MK-1 flyer's underall, cotton undershirt/cotton drawers, chemical protective socks, disposable footwear covers, aircrewman's cape, and chemical protective gloves and inserts. The MK-1 Flyer's Underall is a one-piece chemical liner made from nylon-viscose, non-woven fabric treated with flurochemical liquid repellant. The inner surface is coated with activated charcoal. The cotton undershirt and drawers are worn under the chemical liner to prevent skin irritation from the charcoal lining and to minimize perspiration contamination of the chemical liner. The chemical protective socks are vapor agent impermeable; made of 4 mil polyethylene and protect the individual's feet from CB agents. The disposable footwear covers are clear plastic disposable (one-time use only) footwear covers designed to protect the wearer from contamination. The aircrewman's cape is a large clear disposable plastic bag, designed to be worn over the body to protect the user from liquid contamination. The chemical protective gloves and inserts are the standard butyl of 7 mil thickness, with the standard white inserts of 100% cotton knit. The primary user include the US Navy and US Marine Corps.

Figure A-4. A/P22P-9A (V) Below the Neck Protective Assembly

e. Wet Weather Clothing (see Figure A-5). Wet weather gear provides an ensemble for wear over IPE. Wet weather gear provides initial protection against liquid CB agents and radioactive alpha and beta particles in a cold and/or wet climate, both ashore and aboard ship. The wet weather clothing is made of green chloroprene coated nylon. The jacket-style parka has a slide fastener with moisture barrier flaps, patch pockets and a permanently attached hood. Users include USA, USN, USMC and USAF personnel.

Figure A-5. Wet Weather Gear

f. Nuclear, Biological, and Chemical (NBC) Bag (see Figure A-6). The Chemical Equipment Protective Bag is constructed of an abrasion-resistant nylon and is designed to consolidate and transport NBC defense items such as IPE components and decontamination kits. The bag can no longer hold the entire IPE ensemble because of the change from chemical protective footwear covers to GVOs/BVOs. The bag comes in one size and has a four color woodland camouflage pattern.

Figure A-6. Nuclear, Biological, and Chemical Equipment Bag

g. Suit, Contamination Avoidance and Liquid Protective Suite (SCALP) (see Figure A-7). The SCALP Is a four piece ensemble made of polyethylene-coated Tyvek® and consists of a jacket, trousers, and two footwear covers. It is designed to be worn over the chemical protective overgarment (BDO or JSLIST) and chemical protective overboots. The footwear covers consist of 12 mil embossed polyethylene soles and The footwear covers consist of 12 mil embossed polyethylene soles and components provide protection from gross liquid contamination for a period of up to one hour. Users include land force elements such as explosive ordnance disposal, technical escort, or medical units.

Figure A-7. Contamination Avoidance and Liquid Protective Suite (SCALP)

h. Joint Protective Aircrew Ensemble (JPACE) (see Figure A-8). The joint protective aircrew ensemble (JPACE) (Figure A-8) is a joint developmental program JPACE will provide chemical and biological (CB) protection for all service air crews, including those in both fixed wing and rotary aircraft.

Figure A-8. Joint Protective Aircrew Ensemble (JPACE) (Developmental Item)

i. Apron, Toxicological Agents Protective, M2 (see Figure A-9). The apron, toxicological agents protective, M2 (TAP), is intended for personnel whose duties may bring them into contact with liquid CB agents. For example, those who work with toxic munitions, perform decontamination in a field environment, handle contaminated clothing and equipment at a decontamination site, and handle and treat chemical agent casualties could use this item of clothing.

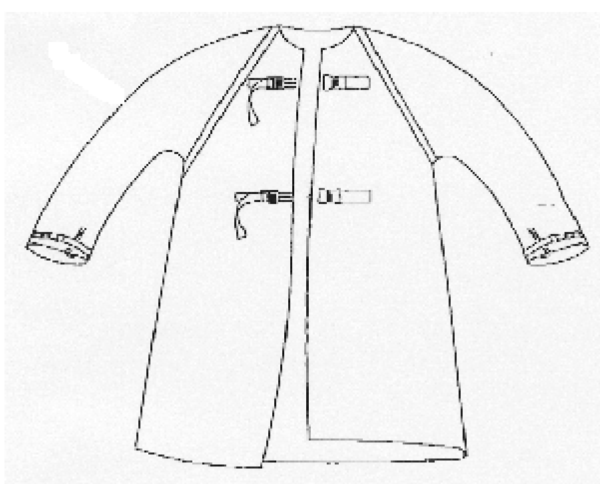


Figure A-9 Apron, Toxicological Agents Protective, M2

j. Improved Toxicological Agent Protective Ensemble (ITAP) (see Figure A-10). The ITAP suit provides protection for up to one hour in a toxic CB environment. The suit is capable of being decontaminated for a minimum of 5-reuses, 2-hours per use, after vapor and particulate contamination. Primary users of this special purpose equipment would be special purpose response teams (i.e., hazardous materials teams).

Figure A-10. Improved Toxicological Agent Protective Ensemble (ITAP)

k. Self-Contained Toxic Environment Protective Outfit (STEPO) (see Figure A-11). The STEPO provides a totally encapsulating protective ensemble for protection in a TIC environment. The ensemble incorporates a self-contained breathing apparatus (with a tether/emergency breathing apparatus option), a battery powered cooling system, and a hands-free communications system. The STEPO is used in extremely hazardous areas where contact with chemical agents, POLs, missile fuels and/or toxic industrial chemicals can occur. The STEPO provides the wearer with clean, closed circuit breathing air rather than the filtered air provided in the TAP ensemble. The STEPO will provide 4 hours of protection. The primary user of the STEPO would be special purpose response teams (i.e., hazardous materials response teams).

Figure A-11. Self-Contained Toxic Environment Protective Outfit (STEPO)

l. Chemical Protective Glove Set (see Figure A-12). The glove sets come in three thicknesses; (7, 14, and 25 mil). The 7-mil glove set is used by personnel such as medical, teletype, and electronic repair personnel whose tasks require extreme tactility and/or sensitivity and will not expose the gloves to harsh treatment. The 14 mil glove set is used by personnel such as aviators, vehicle mechanics and weapon crews whose tasks require tactility and sensitivity and will not expose the gloves to harsh treatment. Use of the more durable 25-mil glove set is for personnel who perform close combat tasks and other types of heavy labor. The glove protects against CB agents and alpha and beta radioactive particles as long as they remain serviceable. If the 14 and 25 mil glove set becomes contaminated with liquid chemical agent, decontaminate or replace them within 24 hours after exposure. If the 7-mil glove set becomes contaminated, replace or decontaminate within 9 hours after exposure. The contaminated gloves may be decontaminated with a 5 % chlorine solution or a 5 % HTH and water solution. Primary users include all the services.

Figure A-12. Chemical Protective Glove Set

m. Improved Chemical, Biological (CB) Protective Glove (see Figure A-13). The improved Chemical/biological (CB) Protective Glove is a developmental program item that will supply a glove system that exhibits increased durability and provides moisture vapor transmission.

Figure A-13. Improved Chemical/Biological Protective Glove (Developmental Item)

n. Green Vinyl Overshoe (GVO), Black Vinyl Overshoe (BVO), and Multipurpose Overboot (MULO) (see Figure A-14). The GVO is a plain olive drab (OD) vinyl green overshoe with elastic fasteners. The BVO is very similar to the GVO, except for the change in color and black enlarged tabs on each elastic fastener. Personnel wear the green or black vinyl overshoe over their combat boots to protect feet from contamination by all known agents, vectors, and radiological particles (alpha/beta) for a maximum of 14 days. Protection continues past 14 days provided the GVO/BVO remains serviceable. Wearing the GVO/BVO with combat boots provides 24 hours of protection against all known CB agents, following contamination. Decontaminate the GVO/BVO with a 5 % chlorine solution or a 5 % HTH and water solution. If signs of deterioration following decontamination. The MULO is also designed for wear over the combat boot, jungle boot, and intermediate cold/wet boot. The MULO provides 60 days of durability and 24 hours of protection against CB agents. The primary users include all services.

Figure A-14. Green/Black Vinyl Overshoe

o. Chemical Protective Footwear Cover (CPFC). The CPFC are impermeable and protect feet from CB agents, vectors, and radiological dust particles for a minimum of 24 hours, as long as they remain serviceable. CPFCs can be decontaminated using 5% chlorine solution. The USN continues to use the CPFC.

p. Chemical Protective Helmet Cover (see Figure A-15). The Chemical Protective Helmet Cover is a one piece configuration made of butyl coated nylon cloth and gathered at the opening by an elastic webbing enclosed in the hem. The covers come in one size and are of olive green color. The helmet cover protects the helmet from CB contamination and radioactive alpha and beta particles. The primary users include USA and USMC units.

Figure A-15. Chemical Protective Helmet Cover

q. Joint-Firefighter's Integrated Response Ensemble (J-FIRE) (see Figure A-16). The J-FIRE configuration consists of the JSLIST overgarment as the chemical protective component, firefighter proximity suit, nomex hood, modified structural helmet, CB butyl rubber gloves with liners, fire protection gloves, firefighting protective boots, SCBA with chemical warfare (CW) kit, and a carrying bag. The J-FIRE ensemble may contain a proximity glove with built-in chemical protective feature instead of the separate butyl rubber gloves and fire protection gloves. The primary users include special purpose teams such as fire fighters.

Figure A-16. Joint-Firefighter's Integrated Response Ensemble (J-FIRE)

34. PROTECTIVE MASKS

27. The field protective masks described in this paragraph will not protect the wearer from ammonia or carbon monoxide. They are not effective in certain spaces when oxygen content in the air is too low. Glasses or contact lenses cannot be worn with these masks (except for the M43). Proper PMCS is essential to ensure serviceability.

a. Chemical-Biological Mask: Field M40/M40A1 (see Figure A-17). The M40 series chemical-biological mask consists of a silicone rubber facepiece with in-turned periphery, binocular eye lens system and elastic head harness. Other features include front and side voicemitters, allowing better communication particularly when operating communications, drink tube, clear and tinted inserts, and a filter canister with NATO standard threads. The M40A1 mask provides respiratory, eye, and face protection against CB agents, toxins, radioactive fallout particles, and battlefield contaminants. The canister filter cannot be changed in a contaminated environment. The mask was-not designed for that contingency. The primary users include USA, and USMC units, and select use by USN and USAF personnel.

Figure A-17. Chemical-Biological Mask M40/M40A1 Series

b. Chemical-Biological Mask: Combat Vehicle M42A1 (see Figure A-18). The M42A1 chemical-biological mask has the same components as the M40. In addition, the M42A1 combat vehicle crewman mask has a detachable microphone for wire communication. The canister on the M42A1 mask is attached to the end of a hose and has an adapter for connection to a gas particulate filter unit. Just as the M40 mask, the filter canister is designed with NATO standard threads. The M42A1 mask has a second skin used for protection from liquid agents, a quick doff hood, clear and neutral gray outserts, and canister interoperability for easy attachment. The primary users include USA and USMC units.

Figure A-18. Chemical-Biological Mask: Combat Vehicle M42A1

c. Chemical-Biological Mask: Aircrew Aviator M45 (see Figure A-19). The M45 aircrew mask provides respiratory, eye, and face protection. The mask provides the required protection with the aid of forced-ventilation air, while maintaining compatibility with rotary-wing aircraft sighting systems and night vision devices. The M45 aircrew mask protects the user against all known chemical and biological agents and radiological particles without the aid of forced air ventilation, while maintaining compatibility with rotary-winged aircraft sighting systems and night vision devices. The mask provides a microphone, drinking tube, close-fitting eye lenses, front and side voice-mitter for face-to-face and phone communications, low-profile canister interoperability hose assembly for both hose and face- mounted configurations and the mask also comes with a hood and second skin. The M45 Mask is also used to support service personnel who cannot be fitted with the standard M40-series or MCU-2A/P series protective masks. The primary users include USA and USMC units.

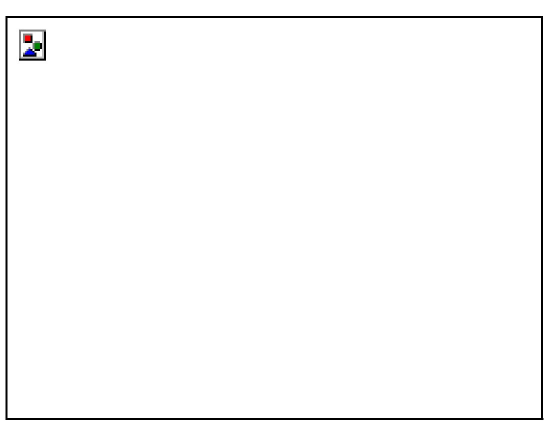


Figure A-19. Chemical-Biological Mask: Aircrew Aviator M45

d. Chemical-Biological Mask: Aircraft M43 (see Figure A-20). The M43 mask provides the required CB agent protection and allows for compatability with the AH-64 attack helicopter helmet and display sighting system and the optical relay tube. The mask comes with a portable blower/filter system that operates on battery or aircraft power to maintain positive pressure in the facepiece, and an inhalation air distribution assembly for regulating the flow of air. Additionally, the mask provides for external voice or wire communications and a drink tube assembly. The primary users include USA Apache helicopter aviators.

Figure A-20. Chemical-Biological Mask: Aircraft M43

e. Chemical-Biological Mask: M48 (see Figure A-21). The M48 Chemical-Biological Aircraft Mask was developed for the AH-64 Apache helicopter aviators. It provides face, eye, and respiratory protection against chemical-biological agents and radioactive particles. The M48 mask has a lightweight motor blower that is mounted on the user during dismounted operations and is mounted to the airframe during flight operations. The motor blower provides filtered, breathable air that keeps the head cool and prevents the eye lens from fogging. While wearing the M48 mask, crewmembers can perform their mission in an

NBC environment inside or outside of the aircraft. The M48 will replace the M43 Chemical-Biological Mask: Aircraft M43 and will be worn by Apache helicopter aviators.

Figure A-21. Chemical-Biological Mask: M48

f. Aircrew Eye/Respiratory Protection (AERP) (see Figure A-22). The AERP (replaces the MBU-13/P system for aircrews) is a protective mask which enables USAF aircrews to conduct mission operations in a chemical-biological environment. The AERP system includes a protective hood assembly with a standard MBU-13/P mask, an intercom for ground communication, and a blower assembly that provides de-misting. The blower is stowed during flight operations on a bracket that is mounted inside the aircraft. The primary users includes USAF units.

Figure A-22. Aircrew Eye/Respiratory Protection (AERP)

g. CB Respiratory System (A/P22P-14 [V] Nondevelopmental Item (NDI) (see Figure A-23). The CB Respiratory System is a self-contained protective ensemble designed for all forward deployed rotary wing (version 1 for USN) and fixed wing (versions 2-4 for USN and USMC) aircrews. The design incorporates a CB filter, dual air/oxygen supply and a cross-over manifold with ground flight selector switch to filter air for hood ventilation, and filter air for breathing. The primary user includes USN and USMC aircrews.

Figure A-23. Figure 1-23. A/P22P-9A (V) Above the Neck Respirator Assembly

h. MCU-2A/P Protective Mask. The MCU-2A/P mask (see Figure A-24) with a serviceable canister filter installed protects the faces, eyes, and respiratory tract from chemical and biological warfare agents and radioactive dust particles. A properly worn mask provides USN and USAF personnel a gas-tight face seal which prevents unfiltered air from reaching the wearer's respiratory system. The major components of the MCU-2A/P mask include an outlet valve assembly, outlet valve cover, a drinking tube, a nosecup, an inlet valve, lens, outserts, and canister. The accessories for the MCU-2A/P mask include, a mask carrier, protective hood, mask outserts, and a special canteen drinking cap. The primary user includes USN and USAF personnel.

MCU-2A/P Protective Mask

Figure A-24. MCU-2A/P Protective Mask

i. MCU-2/P Protective Mask (see Figure A-25). The MCU-2/P series protective mask (Figure 1-22) is the eye respiratory protection equipment used aboard ship for chemical, biological and radiological (CBR) defense. It has a single filter and two voicemitters, one on the front of the mask for speaking directly into a telephone or radio handset and one at the side to allow personnel nearby to hear. The mask has a drinking tube that connects to a canteen with an M1 Canteen cap. The MCU-2/P is being phased out and replaced by the MCU-2A/P series protective mask. The primary user includes the USN.

Figure A-25. MCU-2/P Protective Mask

j. M17A1/M17A2 Series Field Protective Mask (see Figure A-26). The M17A1/M17A2-series chemical-biological mask, with the M6A2 hood, protects against field concentrations of all known chemical and biological agents in vapor or aerosol form. The M17A1/M17A2 series protective mask is no longer standard issue for military personnel; however, it could

M6A2 HOOD

still be used for issue to civilians during missions such as noncombatant evacuation operations.

Figure A-26. Mask Protective Field M17A1/M17A2 Series

k. Joint Service General Purpose Mask (JSGPM) (see Figure A-27). The JSGPM (Figure 1-26) will eventually replace the M40/M42/MCU-2/P series masks. The JSGPM will provide face, eye, and respiratory protection from battlefield concentrations of CB agents, toxins, toxic industrial materials and radioactive particulate matter. It will also provide improved protection for selected Toxic Industrial Chemicals (TICs).

Figure A-27. Joint Service General Purpose Mask (JSGPM) (Developmental Item)

l. M41 Protection Assessment Test System (PATS) (see Figure A-28). The PATS is designed to check the readiness of protective masks and to verify that a protective mask while worn by an individual is capable of providing the required fit factor/protection factor (PF). The PATS verifies that the fit of the mask to the person's face is acceptable, and that there are no critical leaks in the mask system. In addition to these features, the PATS can also be used to help screen for unserviceable masks, assist in determining if preventive maintenance checks and services (PMCS) have been conducted properly on critical components and can assist in training personnel on the proper wearing of the mask. The PATS is currently used by USA, USMC, and USAF units. Additionally, the PATS requires periodic calibration, and the calibration is scheduled and coordinated through service logistics channels.

Figure A-28. M41 Protection Assessment Test System (PATS)

m. Mask Leakage Tester, TDA-99M (see Figure A-29). The TDA-99M is a one-man portable, unit level system that is capable of determining serviceability, PMCS adequacy,

and identifying defective components of protective masks. Users include USA, USN, USAF, and USMC units.

Figure A-29. Mask Leakage Tester TDA-99M

n. Voice Communication Adapter (VCA). The VCA is a low risk program providing additional voice amplification capability to the M40/M42 mask. The VCA is a joint program between the US Army and USMC.

o. Universal Second Skin. The Universal Second Skin is one of the components of a pre-planned product improvement (P3I) in the M40/M42 series mask. The universal second skin provides liquid agent protection for the mask faceblank material. The primary users include USA and USMC units.

p. NBC Protection Items Stowed in the Carrier, Protective Mask. Each branch of service will specify what items are to be carried for the protection of their personnel based on associated missions. Generally, current mask carriers accommodates three NAAKs, M8 detector paper, technical reference, mask hood (mounted on the mask in most cases), mask outserts (mounted on the mask in most cases), waterproof bag, canteen cap, and personnel and equipment decontaminating kit (M291 SDK and/or M295 decon kits).

35. TOXIC INDUSTRIAL MATERIAL (TIM) PROTECTION

a. Level A (see Figure A-30). Level A protective suits provide the greatest level of skin and respiratory protection. It consists of a totally encapsulating suit with gloves and boots attached. SCBA is usually worn inside the suit. Two pair of gloves, latex then chemical resistant, are worn under the suit gloves. Chemical resistant boots are worn over the suit boots. A radio may be worn under the suit. Optional items such as hard hats, cooling vests, and kneepads may be worn. This ensemble should be worn when the highest level of respiratory, skin and eye protection is required.

Figure A-30. Level A Protection

b. Level B (see Figure A-31). Level B protection should be considered when the highest level of respiratory protection is needed but with a lesser level of skin and eye protection. This level consists of non-encapsulating, chemical resistant suits, often called splash suits or rain suits. Level B comes in several configurations, none of which are vapor tight. SCBA is worn either inside or outside the suit depending on the configuration. Chemical resistant outer boots are worn and three pairs of gloves may be used. Latex inner gloves are covered with chemical resistant gloves, and then a pair of chemical resistant outer gloves may cover both of these for additional protection. Level B is the minimum level recommended for initial site entry until all hazards have been identified and are being monitored.

Figure A-31. Level B Protection

c. Level C (see Figure A-32). Level C protection can be selected when the airborne substance is known and is being monitored. All criteria must be met for the use of air purifying respirators (APR) and the proper filters for the known hazard are present. Monitoring the air must continue throughout the operation to ensure that the Level C protection remains effective for the environment. An escape mask should be worn in case of a change in conditions that make the air-purifying mask ineffective. This escape mask will provide protection to the responder during movement to the decontamination line without risking exposure. The Level C ensemble consists of a full facepiece, air purifying respirator, and a chemical agent resistant suit. Chemical agent resistant hood, apron, boots, and gloves should also be worn. The gloves are layered the same as for Level B. Level C protection is similar to MOPP4 in a chemical weapons environment.

Figure A-32. Level C Protection

d. Level D (see Figure A-33). Level D protective ensemble is the work uniform. Level D does not provide any respiratory or skin protection and should not be used at an incident site that presents these hazards. The military battledress uniform or coveralls meet the requirements for this level of protection.

Figure A-33. Level D Protection

36. DECONTAMINATION EQUIPMENT

a. M291 Skin Decontaminating Kit (SDK) (see Figure A-34). The M291 kit consists of a wallet-like carrying pouch containing six individual decontamination packets, enough to do three complete skin decontamination's. The kit allows personnel to decontaminate their skin through physical removal, absorption, and neutralization of toxic agent with no long-term harmful effects. The kit is used for external use only and may be slightly irritating to eyes or skin. Personnel ensure they keep the decontamination powder out of eyes, cuts, or wounds and avoid inhalation of the powder. The primary users include all services.

Figure A-34. M291 Skin Decontaminating Kit

b. M295 Decontamination Kit, Individual Equipment (DKIE) (see Figure A-35). The M295 kit allows personnel to decontaminate their individual equipment through physical removal and sorption of chemical agents. Decontamination is accomplished through sorption of contamination by both the kit nonwoven polyester pad and by the decontaminating powder. It is not approved for skin decontamination. It is decontaminate chemical-biological protective mask/hood, gloves, footwear, weapon, helmet, and load bearing equipment, preclude agent transfer during over-garment exchange, and entry or exit procedures. The primary user includes all services.

Figure A-35. M295 Decontamination Kit, Individual Protection

c. Sorbent Decontamination System, XM100 (see Figure A-36). The XM-100 Sorbent Decontamination System (SDS) is a developmental item, intended to replace the M11s and M13s currently employed in operator spraydown operations associated with immediate decontamination. It is not approved for skin decontamination. The system uses powdered sorbent to remove chemical agent from surfaces. The reactive sorbent is non-toxic and non-corrosive, and requires no water to complete its mission. SDS is designed to operate at temperatures between –25 and 120 °F.

Figure A-36. Sorbent Decontamination System, XM100 (Developmental Item)

d. ABC-M11 Portable Decontaminating Apparatus (see Figure A-37). The ABC-M11 portable decontaminating apparatus decontaminates small areas, such as steering wheels or other equipment operating areas that personnel may have contact with. It is a steel container with aluminum spray-head assembly and a nitrogen gas cylinder that provides the pressure. It is filled with 1-1/3 quarts of DS2 Decontaminating Solution, which is sufficient for decontaminating 135 square feet of contamination. The effective spray range is 6 to 8 feet. The primary users include USA, USMC, and USAF units.

Figure A-37. ABC-M11 Portable Decontaminating Apparatus

e. M13 Decontaminating Apparatus, Portable (DAP) (see Figure A-38). The man portable M13 consists of a vehicle mounting bracket, a pre-filled fluid container containing 14 liters of DS2 decontaminating solution, and a brush-tipped pumping handle connected to the fluid container by a hose. The fluid container and brush head are both disposable. The M13 can decontaminate 1,200 square feet per fluid container. The combination of spray pump and brush allows personnel to decontaminate hard to reach surfaces, and remove thickened agent, mud, grease and other material. The primary users include USA, USMC, and USAF units.

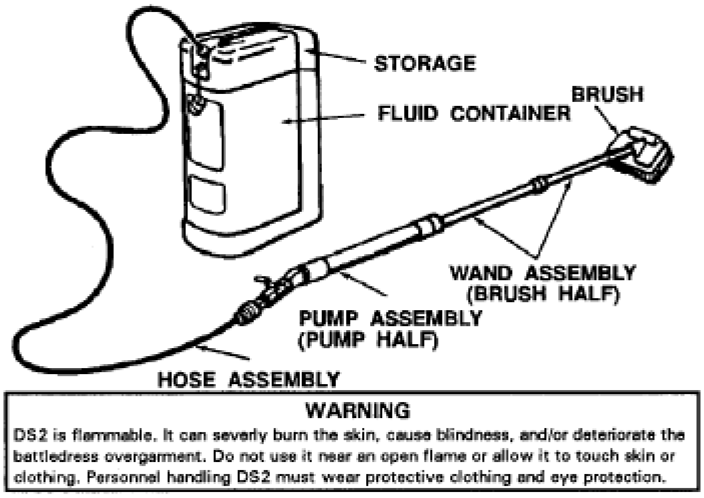


Figure A-38. M13 Decontaminating Apparatus, Portable DAP

37. CHEMICAL DETECTOR PAPER/KITS

a. M8 Chemical Agent Detector Paper (see Figure A-39). The M8 Chemical Agent Detector Paper is used to detect the presence of liquid VGH chemical agents. When a sheet is brought in contact with liquid nerve or blister agents, it reacts with chemicals in the paper to produce agent specific color changes. The paper is blotted on a suspected liquid agent and observed for a color change (liquid agent absorption). V-type nerve agents turn the M8 Paper dark green, G-type nerve agents turn it yellow, and blister agents (H) turn it red; and the paper cannot be used to detect chemical agents in water or vapor or aerosols. The primary user includes all services.

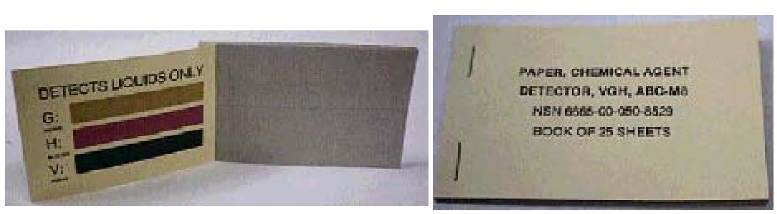


Figure A-39. M8 Chemical Agent Detector Paper

b. M9 Chemical Agent Detector Paper (see Figure A-40). M9 Paper is placed on personnel and equipment to identify the presence of liquid chemical agent aerosols. It will turn pink, red, reddish brown or red-purple when exposed to liquid agent and can detect but not identify the specific agent. As soon as it indicates the presence of chemical agents, protective action must be taken. The primary user includes all services.

Figure A-40. M9 Chemical Agent Detector Paper

c. M256A1 Chemical Agent Detector Kits (see Figure A-41). The M256A1 Chemical Agent Detector Kit is a portable, expendable item capable of detecting and identifying hazardous concentrations of chemical agents and is used after a chemical attack to determine if it is safe to unmask or reduce the protective posture level. It also determines the type of agent present and helps to confirm the presence or absence of hazardous agent concentration of agent. Each kit has the capability to test for blister agents, blood agents, a star test spot for nerve agents, and a lewisite detecting tablet and rubbing tab. Each test spot or detecting tablet develops a distinctive color that indicates whether a chemical agent is or is not present in the air. The primary user includes all services.

Figure A-41. M256A1 Chemical Agent Detector Kit

38. FIRST AID EQUIPMENT

a. Nerve Agent Antidote Kit (NAAK) Mark I (see Figure A-42). Nerve agent poisoning requires immediate first-aid treatment. Personnel receive three NAAKs, Mark I, for this purpose. Personnel may become subject to nerve agent poisoning on the battlefield. Immediate treatment with the NAAK is required if they are to survive. The NAAK consists of one small autoinjector containing atropine and a second autoinjector containing pralidoxime chloride. A plastic clip holds the two injectors together. Store the NAAK in the accessory storage pocket inside your mask carrier. Protect the NAAK from freezing. See FM 8-285/NAVMED P-504/AFJMAN 4-149/FMFM 11-11 for more information on the NAAK. The NAAK can also be issued in a Mark II configuration. The two auto injectors are issued without the plastic clip to hold them together.

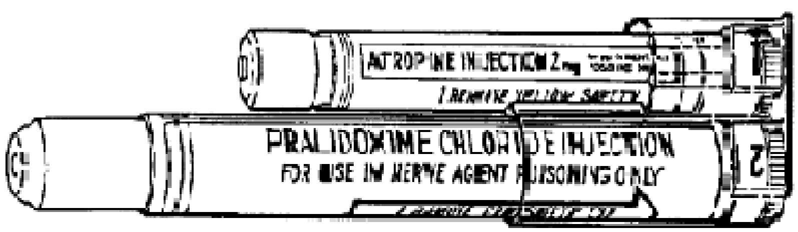


Figure A-42. Nerve Agent Antidote Kit (NAAK), Mark I

b. Antidote Treatment Nerve Agent Auto Injector System (ATNAA) (see Figure A-43). Nerve agent poisoning requires immediate first-aid treatment. Personnel receive three ATNAAs for this purpose. Personnel may become subjected to nerve agent poisoning on the battlefield. Immediate treatment with the ATNAA is required if they are to survive. The ATNAA is a multichambered device that consists of four components: the auto-injector (with atropine and 2 PAM chloride C1 piggy-backed in separate chambers), a spring activated needle, a safety cap, and carrying case. Store the ATNAA in the accessory storage pocket inside your mask carrier. Protect the ATNAA from freezing. The ATNAA will replace the NAAK. See FM 8-285/NAVMED P-504/AFJMAN 4-149/FMFM 11-11 for more information on the ATNAA.

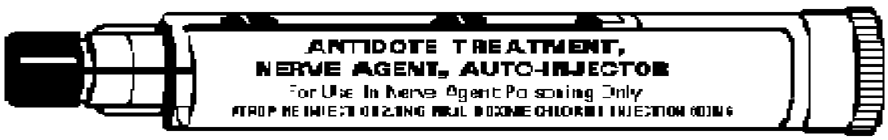


Figure A-43. Antidote Treatment Nerve Agent Auto Injector System (ATNAA)

c. Nerve Agent Pretreatment Pyridostigmine (NAPP) (see Figure A-44). NAPP is an adjunct to the NAAK/ATNAA. This investigational new drug pretreatment enhances individual survivability in a nerve agent chemical environment. Each individual is initially issued one NAPP. Personnel will begin taking their NAPP tablets when ordered by their commander based on assessment of possible agent exposure within the next few hours or days. One tablet is to be taken on a continuous basis once every eight hours until all 21 tablets have been taken or the individual has been directed to discontinue taking the tablets. NAPPs should be stored/refrigerated in temperatures ranging from 35°F to 46°F. If the medication is removed from the refrigerator for a total of six months, it should be assumed that it has lost its potency and should not be used.

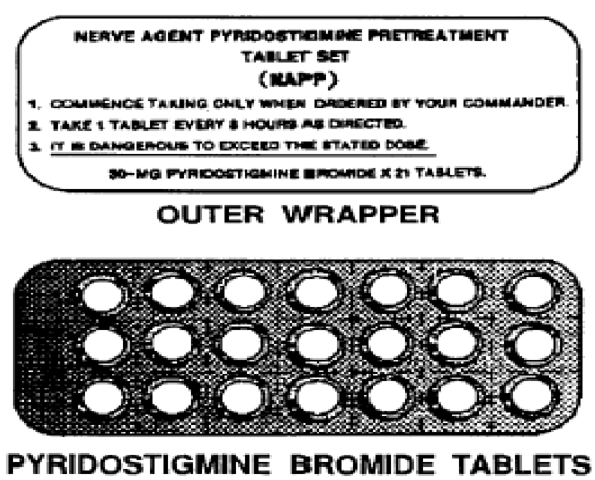


Figure A-44. Nerve Agent Pretreatment Pyridostigmine (NAPP)

d. Convulsant Antidote for Nerve Agents (CANA) (see Figure A-45). The CANA is similar to existing autoinjectors but modified to hold a 2-milliliter volume of diazepam. The CANA is a disposable device for intramuscular delivery of diazepam to a buddy who is incapacitated by nerve agent poisoning. It is administered by buddy aid only and is an adjunct to the NAAK/ATNAA kit. The CANA is an individually issued item.

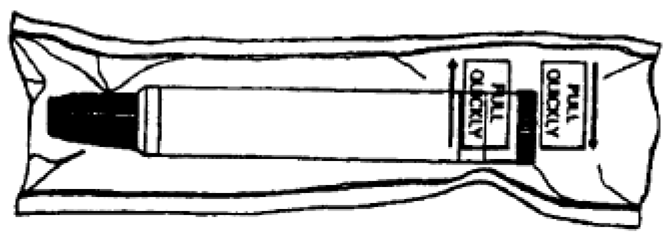


Figure A-45. Convulsant Antidote for Nerve Agents (CANA)

e. Skin Exposure Reduction Paste Against Chemical Warfare Agents (SERPACWA) (see Figure A-46). SERPACWA is a topical skin protectant that will protect personnel from penetration or absorption of vapor particulate, and/or liquid CB agents. SERPACWA will be used on bare skin in conjunction with MOPP ensembles. SERPACWA does not interfere with sun screens, skin or clothing repellants, lip balm, hand lotions or skin camouflage products. When applied at select locations on the body (i.e., wrist, neck, ankles, armpits, groin area, and waist), SERPACWA creates an inert physical barrier to CB agent without compromising normal skin function. Each service member will be issued three SERPACWA packets. An application from one packet is intended to last approximately eight hours. SERPACWA will be applied at discretion of the commander. (Note: Personnel do not open their IPE to apply SERPACWA in an NBC environment).

Figure A-46. Skin Exposure Paste Against Chemical Warfare Agents (SERPACWA)

39. RELATED EQUIPMENT (CHEMICAL MONITORS/RADIATION DETECTION INSTRUMENTS/BIOLOGICAL DETECTORS)

28. Commanders must ensure that the appropriate section/squad/department has personnel trained to operate and maintain the assigned NBC defense equipment. Operation and maintenance of individual and unit NBC equipment are both a leadership and individual responsibility. Not everyone in the unit will be provided these items of NBC equipment, but any individual may become responsible for them or need to use them. The items may include chemical agent monitors, radiac sets, and other related items.

a. Chemical agent monitor (CAM) (see Figure A-47). The chemical agent monitor (CAM) is designed to be used to detect chemical agent vapor (nerve or blister) and provide a readout of the relative concentration of vapor present. It can be employed to monitor-personnel or vehicles prior to decontamination and/or inside collective protection shelters. When an agent vapor is detected, the CAM will provide a bar graph indication of the relative concentration of the sample. The primary user includes all services.

Figure A-47. Chemical Agent Monitor (CAM)

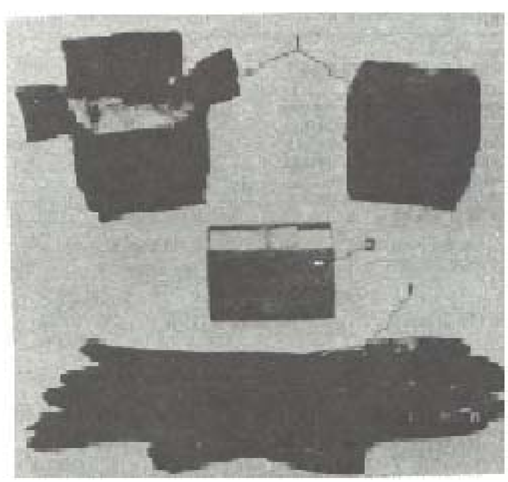
b. Improved Chemical Agent Monitor (ICAM) (see Figure A-48). The Improved Chemical Agent Monitor (ICAM) identifies nerve and mustard agent contamination on personnel and equipment. The ICAM provides the operator instantaneous feedback of chemical hazard levels, and quickly determines the presence of contamination on personnel and equipment. The ICAM is a hand-held, individual-operated, post-attack device for monitoring chemical agent contamination on people and equipment. The monitor detects and discriminates between vapors of nerve and mustard agents. The primary user includes all services.

Figure A-48. Improved Chemical Agent Monitor (ICAM)

c. Joint Chemical Agent Detector (JCAD) (see Figure A-49). The Joint Chemical Agent Detector is a developmental item, and is a combined portable monitoring and small point chemical agent detector for aircraft, shipboard, and individual applications. This hand-held, pocket-sized detector is designed to automatically detect, identify, and quantify chemical agents inside the aircraft or ship.

Figure A-49. Joint Chemical Agent Detector (JCAD) (Developmental Item)

d. Soil Sampling Kit, M34 (see Figure A-50). The M34 sampling kit is intended for use by authorized USA NBC personnel to perform sampling of soil, surface matter, and even water. The primary use of the kit is to gather soil samples for processing at laboratories.



The carrier is used as a shipping container for transmitting samples to the laboratories.

Figure A-50. Soil Sampling Kit, CBR Agent M34

e. Sampling Kit, CBR Agent (M34A1) (see Figure A-51). The M34A1 Kit is configured to collect liquid, soil, surface, and small solid samples, suspected of being contaminated with chemical agents, for transport to a laboratory for analysis. The kit contains teflon containers and expendable materials for taking 2-3 of each type of sample. The jars are capable of containing chemical agents at high (120º F) and low temperatures. The primary user includes USA personnel.

Figure A-51. Sampling Kit, CBR Agent, M34A1

f. M18A2 Chemical Agent Detector Kit (see Figure A-52). The M18A2 chemical agent detector kit can detect and identify dangerous concentrations of nerve agent, blister agents, blood agents, and choking agents in about 1-4 minutes. The kit can also be used to confirm results of the M256A1 kit. The kit also contains a booklet of M8 chemical agent detector paper to detect liquid agents. The M8A2 kit is used by special teams such as surety teams or technical escort personnel.

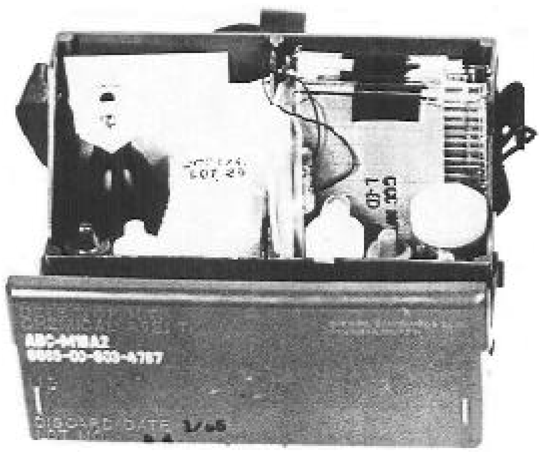


Figure A-52. M18A2 Chemical Agent Detector kit

g. M8A1 Automatic Chemical Agent Alarm (ACAA) (see Figure A-53). The M8A1 ACAA is a system that continuously samples the air to detect the presence of dangerous concentrations of G and V type nerve agent vapors. The M8A1 may be employed in a number of configurations, but all configurations differ primarily in their mountings and power supplies: ground mounted and battery operated, or mounted on a vehicle and powered by the vehicle's electrical system. The M43A1 detector unit will alarm within about 1-2 minutes from exposure to the agent. The M42 alarm unit is a remote visual and audible alarm. The M42 alarm unit may be placed up to 400 meters from the M43A1 detector unit to give users warning of an approaching agent cloud. The primary users include land and aerospace forces (USA, USMC, USAF).

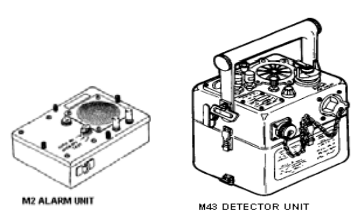


Figure A-53. M8A1 Automatic Chemical Agent Alarm

h. M22 Automatic Chemical Agent Detection Alarm (ACADA) (see Figure A-54). The M22 ACADA is a man-portable, point sampling alarm system that detects and identifies all nerve agents, mustard, and lewisite, by class. ACADA provides concurrent nerve and blister agent detection, improved sensitivity and response time, agent identification capability, improved interference rejection, extensive built-in test, a data communications interface, and the capability to be programmed for new threat agents. It replaces the M8A1 Alarm as an automatic point detector and augments the CAM as a survey instrument. The primary users include land and aerospace units.

Figure A-54. M22 Automatic Chemical Agent Detection Alarm (ACADA)

i. M90 Automatic Agent Detector (see Figure A-55). The M90 is an automatic nerve agent and mustard agent detector that detects agents in vapor form. The system is currently in use by the Air Force. It transmits an alarm by radio to a central alarm unit.

Figure A-55. M90 Automatic Agent Detector

j. Chemical Agent Point Detector System (CAPDS), MK21, MOD1 (see Figure A-56). CAPDS is a fixed system capable of detecting nerve agents in vapor form, using a

simple baffle tube ionization spectrometer. Alarm signals are generated and sent to both damage control central and the bridge. The system has been installed on almost all surface ships.

Figure A-56. Chemical Agent Point Detector System (CAPDS), MK21, MOD1

k. Improved Chemical Agent Point Detector System (IPDS) (see Figure A-57). The IPDS is a shipboard point detector and alarm that replaces the existing shipboard CAPDS. IPDS can detect nerve and blister agent vapors at low levels, and automatically provide an alarm to the ship. The unit is built to survive the harsh sea environment and the extreme electromagnetic effects found on Navy ships.

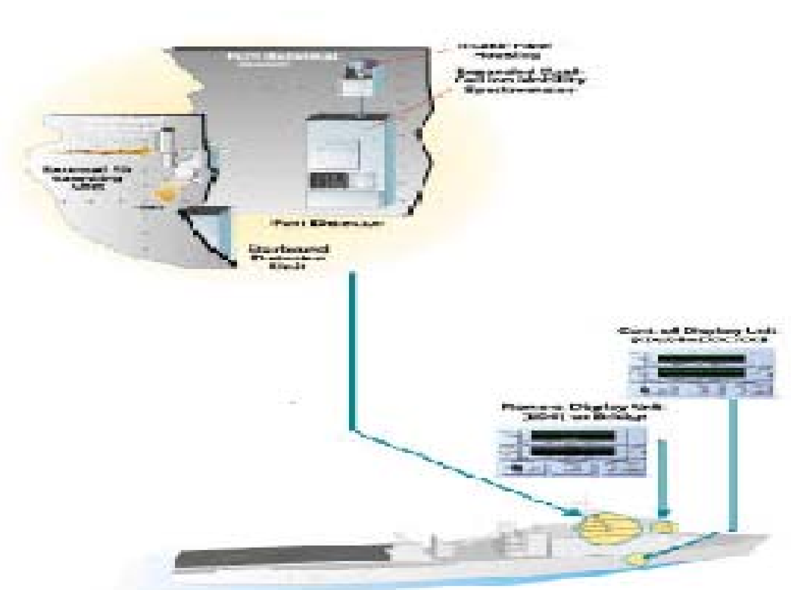


Figure A-57. Improved Chemical Agent Point Detector System (IPDS)

l. Water Testing Kit, Chemical Agent: M272 (see Figure A-58). The Water Testing Kit, Chemical Agents: M272, is a portable lightweight kit that will detect and identify harmful amounts of CW agents when present in raw or treated water. The M272 detects cyanide, mustard, lewisite, and nerve agents when present in water in dangerous amounts. The primary user is the USA.

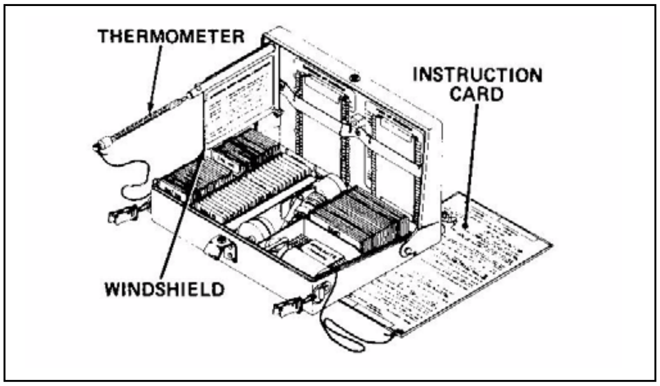


Figure A-58. Water Testing Kit, Chemical Agent: M272

m. Radiac Set AN/UDR-13 (see Figure A-59). The AN/UDR-13 "Pocket" Radiac Set (Figure E-27) is designed to detect and measure nuclear radiation from fallout, radiological contamination and nuclear detonations. It is a combined rate meter and tactical dosimeter, and measures dose rate from 0.1-999 cGy/hr, and measures total dose from 0.1-999 cGy. It

is capable of measuring prompt gamma/neutron dose from a nuclear event plus gamma dose and dose-rate from nuclear fallout. A push-button pad enables mode selection, functional control, and the setting of audio and visual alarm thresholds for both dose-rate and mission dose. The primary user is the USA and USMC.

Figure A-59. Radiac Set AN/UDR-13

n. Radiac Meter IM-93/UD (see Figure A-60). The IM-93/UD Radiacmeter detects and measures culultive exposure to short-duration high or low intensity X-ray and gamma-ray radiation. The IM-93/UD can be clipped to the user's pocket or, can be attached to some object in the area that is to be measured for total dose radiation exposure. The radiacmeter measures from 0-600 cGY, in increments of 20. The maximum acceptable leakage is 12 cGY/day (24-hours). The primary user is the USA, USN, and USMC.

Figure A-60. Radiacmeter IM-93/UD

o. Radiacmeter IM-147/UD (see Figure A-60). The IM-147/UD radiacmeter detects and measures cumulative exposure to short-duration high or low intensity X-ray and gamma-ray radiation. The IM-147/UD can be clipped to the user's pocket or can be attached to some object in the area that is to be measured for total dose radiation exposure. The radiacmeter measures from 0-50 RADS in increments of 2. The maximum acceptable leakage is 1 cGy/day (24-hours). The primary user is the USA, USN, and USMC.

Figure A-61. Radiacmeter IM-147/PD)

p. Charger Radiac PP-1578A/PD (see Figure A-62). The charger-radiac is a frictional generator of static electricity required to charge the radiacmeters IM-93/UD and IM-147/PD. The PP-1578A/PD and the dosimeters associated with the system are being phased out of service within the US Army. It is being replaced by the AN/UDR-13 “Pocket” Radiac Set.

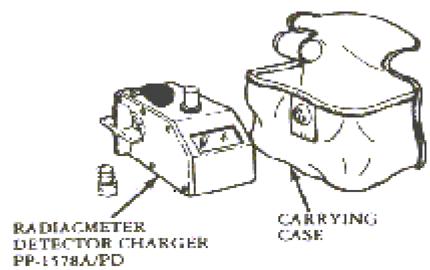


Figure A-62. Charger Radiac PP-1578A/PD

q. Radiac Set AN/VDR-2 (see Figure A-63). The AN/VDR-2 is designed to detect and measure nuclear radiation from fallout and radioisotopes. It is used to perform ground radiological surveys in vehicles or in the dismounted mode by individual personnel as a hand-held instrument. The primary user is the USA and USMC.

Figure A-63. Radiac Set AN/VDR-2

r. Radiac Set AN/PDR-75 (see Figure A-64). The AN/PDR-75 Radiac Set detects and measures nuclear radiation from fallout and nuclear detonations. The system consists of a

Computer Indicator, Radiac CP-696/PDR-75 and a Detector Radiac DT-236/PDR-75. The system provides the capability to monitor and record the exposure of individual personnel to gamma and neutron radiation. The Radiac Computer Indicator CP-696/PDR-75 is used to measure the accumulated neutron and gamma radiation dose recorded by the Radiac Detector DT-236/PDR-75. The Radiac Detector DT-236/PDR-75 is worn by personnel who may be exposed to radiation. The DT-236/PDR-75 allows for radiation monitoring of individual personnel, provides accurate readings for extended periods of time after exposure, and measures from 0 to 999 cGy in any combination of neutron and gamma doses. The primary user is the USA and USMC.

Figure A-64. Radiac Set AN/PDR-75

s. Radiac Set AN/PDR-77 (see Figure A-65). The Radiac Set AN/PDR-77 (Figure E-33) detects and measures alpha and x-ray radiation. It also detects and measures beta and gamma radiation. The system incorporates commercially available measurement electronics, an alpha probe, beta gamma probe, and x-ray probe. The primary user is the USA.

Figure A-65. Radiac Set AN/PDR-77

t. Radiac Set AN/PDR-27R (see Figure A-66). The AN/PDR-27R is designed to detect beta radiation and measure and detect gamma radiation. The primary user is the USN.

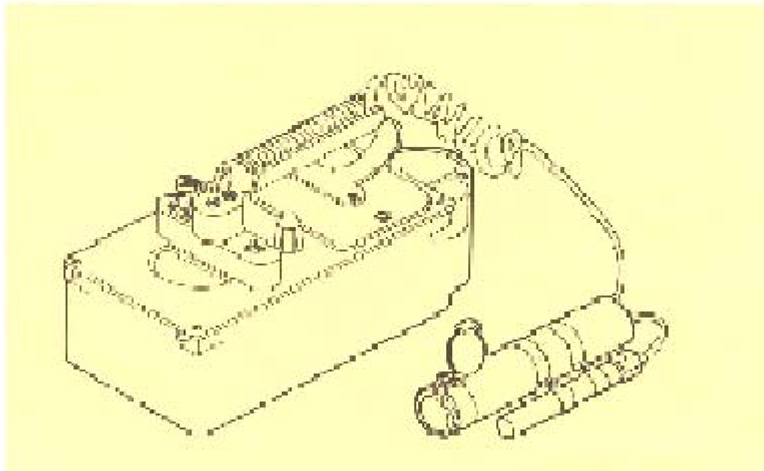


Figure A-66. Radiac Set AN/PDR-27R

u. Radiac Set AN/PDR-43 (see Figure A-67). The Radiac Set, AN/PDR-43 is a pulsed (time controlled) end-window Geiger-Muller type RADIAC which serves as the Navy standard high range beta-gamma survey instrument. The primary user is the USN.

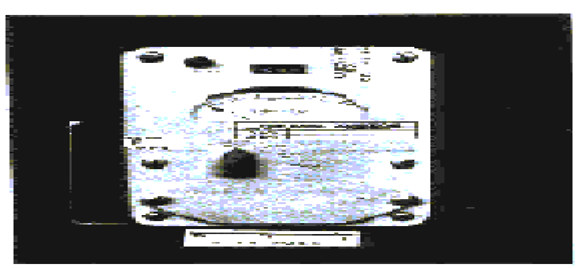


Figure A-67. Radiac Set AN/PDR-43

v. Radiac Set AN/PDR-56 (see Figure A-68). The Radiac Set, AN/PDR-56 is a portable scintillation type instrument used for detection of alpha contamination. The system includes a large and small interchangeable probe with a probe extension. The primary user is the USN and USMC.

Figure A-68. Radiac Set AN/PDR-56

w. Radiac Set AN/PDR-65 (see Figure A-69). The Radiac Set, AN/PDR-65 and AN/PDR-65A is the US Navy standard fixed instrument for measuring gamma radiation intensity and providing dose information. The AN/PDR-65/65A system Measures gamma intensities to 10,000 cGy/hr; and records cumulative doses to 9,999 cGy/hr. The primary user is the USN.

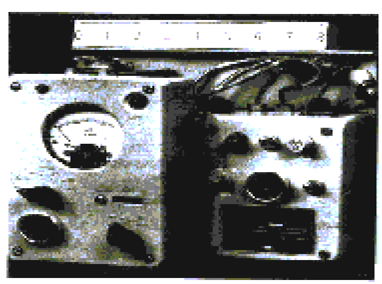


Figure A-69. Radiac Set AN/PDR-65

x. Detector Radiac, Dosimeter DT-60C/PD (see Figure A-70). The Detector Radiac, DT-60C/PD personnel dosimeter (Figure E-38) is a high-range non-self reading dosimeter. A CP-95A/PD reader must be used to determine total dose. The system measures gamma radiation exposure to 600 cGy. The primary user is the USN.

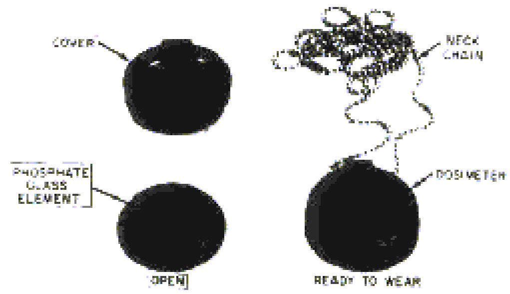


Figure A-70. Detector Radiac, Dosimeter DT-60C/PD

y. Dosimeter Reader, CP-95A/PD (see Figure A-71). The CP-95A/PD Dosimeter Reader is designed to read the DT-60 series personnel Dosimeter. The CP-95A/PD will operate over a range of 0-200 cGy/hr in 10-cGy steps and 0-1000 cGy/hr in 20-cGy steps, with each 100 roentgens a major subdivision. The primary user is the USN.

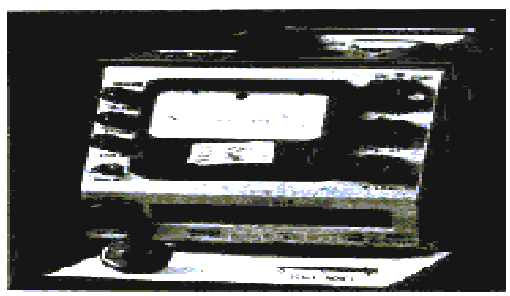


Figure A-71. CP-95A/PD Dosimeter Reader

z. Dosimeter, IM-143B/PD (see Figure A-72). The Pocket Dosimeter, IM-143B/PD is a pen-like, self-reading pocket dosimeter, and is designed to read gamma radiation exposure in the 0-600 roentgens range. The primary user is the USN and USMC.

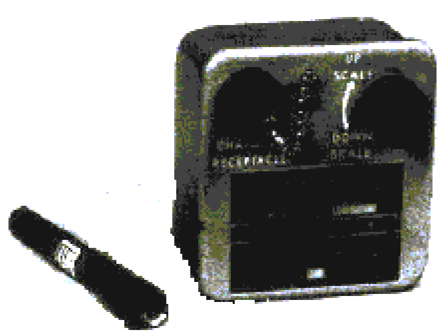


Figure A-72. Dosimeter, IM-143B/PD

aa. Radiac Charger, PP-4276C/PD (see Figure A- 73). The Charger Dosimeter, PP-4276C/PD is a transistorized battery operated charge. The system is designed to charge and zero the pocket dosimeter. The primary user is the USN and USMC.

bb. ADM-300A Multifunctional Survey Meter (see Figure A-74). The ADM-300A Multifunction Survey Meter is a battery-operated, self-diagnostic multiple functional instrument. It is used alone to locate and measure low and high intensity radioactivity in the form of gamma rays or beta particles. It is used with external probes to locate and measure alpha, beta, gama, x-rays, and neutron radiation. The primary user is the USAF.

Figure A-73. ADM-300A Multifunctional Survey Meter

cc. Hand Held Assay (HHA) (see Figure A-74). The Hand Held Assay (HHA), is a specific biological detection component used with the M31 and M31A1 Biological Integrated Detection System (BIDS). The HHA in most cases is used as a backup for the primary specific detection components in the M31 and M31A1-BIDS.

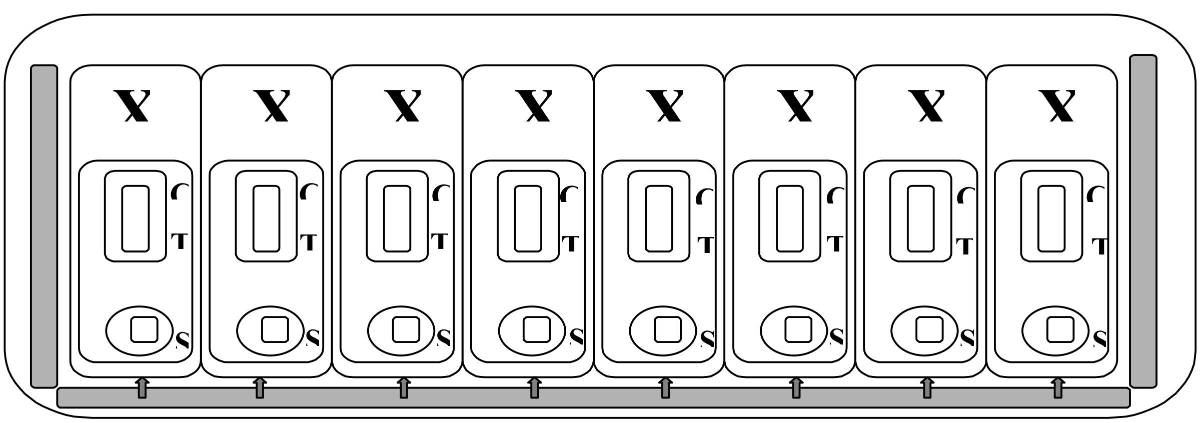


Figure A-74. Hand Held Assay

dd. Detector System, Biological Agent: Joint Portal Shield, M99 (see Figure A-75).

(1) The Portal Shield is a system that can identify up to eight biological agents simultaneously. The Mark III sensor network measures the amount of particles in the air and determines if an increased concentration in the 1-10 micron range constitutes a biological attack. A tricon enclosure protects the sensor from weather and houses the power and environmental control units.

(2) With either an M21 or M22 chemical detector added, the system detects chemical agents in addition to biological agents. It has meteorological and communications

equipment, and an auxiliary generator in case commercial power fails.

Figure A-75. Detector System, Biological Agent: Joint Portal Shield, M99

Appendix B

COLLECTIVE PROTECTION (Guidelines For The NBC Portion of a Collective Protection SOP and Entry/Exit Procedures)

29. This appendix provides example information that could be used to help prepare a collective protection system SOP, support shelter entry/exit procedures, preparation of a shelter for operation, and discusses classes of collective protective and associated equipment.

40. SUGGESTED GUIDELINES FOR PREPARATION OF A COLLECTIVE PROTECTION SYSTEM SOP

30. The information in this paragraph is intended as a guide for units. Each unit should modify and expand this guidance to develop its own SOP. Each SOP should consider peculiarities of unit organization, mission, equipment, and environmental situation. An SOP should delineate operational details of a shelter or van equipped for collective protection. For example, details must include NBC-related duties of a guard (where applicable) and entry and exit procedures.

31. The SOP should consider the following:

- Responsibilities.
- Type and location of the shelter or van.
- Provide resource estimates (i.e., number of shelter management personnel).
- Frequency of and requirements for entries and exits.
- Maintenance of the area around the shelter.
- Personnel entry procedures.
- Emergency operation procedures; interior procedures; operating procedures for shelter attendants; and logistics considerations.
- Number of non-shelter personnel assigned to the same site as the shelter or van.

a. Outline Objective and Responsibilities.

(1) Background. The objective of the shelter plan is to provide the best available physical protection for personnel. Key elements to a successful personnel shelter plan include adequate shelters, personnel familiar with shelter procedures, personnel trained in shelter management, the ability to activate and close shelters at the appropriate times, the ability to stock shelters with required supplies and equipment, and the ability to occupy shelters for extended periods.

(2) Fixed Site Commander. To implement a successful shelter program, the commander develops a comprehensive protection program to provide sufficient shelter spaces for military and emergency essential civilians (include added forces projections for teams and supplies). He also determines the type and quantity of shelters based on the threat, and considers the use of open air CCAs and toxic free areas.

(3) Unit Commander. The commanders responsibilities include –

- Implement instructions and publish unit and facility implementing instructions and checklists for shelter operations as required.
- Plan supply and resupply actions. Logistics planning include preparing for shelter operations for several consecutive days after fallout peaks, or after the onset of chemical-biological contamination. Logistics planning also considers medical requirements.
- Identify shelter management team (SMT) requirements. Ensure SMT members don't have conflicting duties. Identify and train selected unit personnel identified for mobilization in shelter management techniques.
- Train SMTs. Train personnel to operate, maintain, perform inspections and minor troubleshooting of the equipment within the shelter. This should include filtration systems, air conditioning and heating systems, electrical systems, sanitation systems, and communications systems. Personnel also maintain portable detection devices.
- Conduct Operational Planning. Stagger work shifts and rest cycles, as the mission permits, to minimize bottlenecks during shelter processing. Leaders also develop shelter floor plan diagrams, and oversee the operation of the exposure control system.

(4) Fixed Site NBC Personnel Planning. Fixed site NBC personnel plan for expedient hardening to increase the shelter's protective capability during contingency operations. Additionally, they –

- Direct the performance of preventive maintenance and unit level maintenance on available collective protection systems.

- Provide potable water to sustain operations.
- Train SMTs in facility and equipment operation and emergency troubleshooting and repair, shelter management, and shelter equipment use.

(5) Individuals. Individual. Each individual should know the location of their protective shelter and understand shelter processing procedures.

b. Conduct Shelter Planning. For planning purposes all military and emergency essential civilians occupy shelter space during appropriate readiness stages. Planning factors for shelter operations include –

- Minimum shelter team size (for emergency operations and rest and relief shelters used for CB protection, nuclear fallout) should be one shelter supervisor, and one monitor per shift.
- Provide one space per two personnel assigned to a rest and relief shelter.
- Provide positive overpressure of filtered air in collective protection facilities to keep CB agents out of the TFA.
- Provide outward airflow through the airlocks and CCA to minimize hazards.
- Consider the use and location of open air CCAs and TFAs.

c. Ensure Clean Areas Around the Protective Entrance. Provide procedures in an SOP to decontaminate the area surrounding the shelter or van entrance if liquid agent is present. Decon methods could include some of the following techniques – turning over or removing a top layer of soil, removing snow, or adding a clean layer of soil or sand. A clean surface can also be obtained by laying down a piece of plastic, cardboard, canvas, plywood, or other material. Use either soap or detergent with water to decon areas such as entrance steps.

d. Prepare Personnel Entry Procedures. SOPs address entry procedures to ensure the least risk of contamination to personnel and equipment inside and the least interference with tactical operations.

(1) General SOP Guidance. Guidance could include the following:

- In an NBC environment the shelter attendant checks all individuals for contamination, using a detector. Unless the absence of contamination can be verified, assume individuals are contaminated, and they must perform the specific entry procedures.
- Items like chemical detector paper detect agents only in liquid form, most likely thickened liquid agents. Unthickened agents absorb into overgarment materials and cannot be detected by detector paper. However, agent vapor may desorb from clothing inside shelters or vans and present vapor hazards.
- One of the attendant's main NBC duties is assisting entering personnel. He must help them decontaminate and remove contaminated overgarments. He, therefore, must check himself periodically for contamination, especially his gloves.

(2) Detailed SOP Guidance. Describe the steps required for entry into a shelter. Give sufficient detail to avoid confusion. Standardize the procedures, and try and ensure that they are consistent with procedures for larger shelters. Specific instructions for entry into shelters or vans will vary depending on the system (See applicable technical manuals/technical orders, etc. for specific information on system characteristics from which specific entry procedures can be developed). Detailed guidance could include the following-

- Use a chemical agent detector/detector paper or radiacmeter and check for the presence of contamination on individuals.
- Store contaminated items outside. Use protective covers, such as plastic or canvas, near the entrance, and ensure items are not in the path of the entrance door.
- Conduct evaluation of the need for grossly contaminated individuals to enter.

e. Prepare Personnel Exit Procedures. SOPs describe exit procedures for shelter occupants. Emphasize the importance of contamination reduction measures. Include the following in SOPs:

- If an attack is imminent, occurring, or has occurred, occupants leaving the shelter put on MOPP gear.
- Occupants may need to leave the shelter temporarily or for brief periods during an attack. They should carefully avoid contamination of their MOPP gear.

- In a shelter or van with more than one occupant, one may be assigned outside duties. That person should be rotated if possible.

> **WARNING**
>
> When entries are performed in a contaminated environment, monitor every 15 minutes. If detector changes color, or the CAM indicates more then one bar, all individuals should mask until the source of contamination is located and removed and/or further tests indicate contamination is no longer present.

f. Prepare Shelter or Van Emergency Operations SOP. Personnel familiarize themselves with the procedures to follow if an equipment failure occur and the alarm sounds. If an alert is given and the shelter or van is prepared for NBC operations, the alarm system should alert occupants to any of several types of equipment failure. Individuals should handle equipment-related emergencies according to each system's organizational maintenance manual and unit SOP. The following procedures illustrate examples of potential situations that could occur:

- Sudden loss of positive pressure in the shelter. Lights and horns on a component module may signal an alarm. Occupants put on masks. An assigned occupant confirms this signal by checking power, lights, and horn. If alarms are confirmed and compartment positive pressure is lost, occupants must remain masked while the assigned operator pursues the problem. The operator uses the organizational maintenance manual to locate the problem, and, if possible, repair it. The operator may not find the problem readily, or perhaps he cannot repair it. In either case, occupants must dress at the appropriate MOPP level.
- Malfunctioning of Gas-Particulate Filter Unit. If the change-filter light comes on, occupants put on masks. An assigned occupant determines if the filter is operating. He follows procedures in the organizational maintenance manual. If filters need to be replaced, occupants must work in the appropriate MOPP gear until filters are replaced, air is purged, and detectors indicate masks can be removed.

> **WARNING**
>
> Never change filters during a NBC attack

- Contamination of interior by entry of contaminated item or personnel. If the interior becomes contaminated, occupants must work in appropriate MOPP gear until the shelter airflow purges agent from the air, and a detector indicates agent is no longer present. Wipe off any unabsorbed liquid agent from equipment. Use a wet rag if moisture will not harm equipment.

g. Outline Interior Procedures for Occupants. SOPs describe the step-by-step monitoring procedures. If the detector indicates presence of contamination, occupants must

> WARNING
> Ensure the undressing area is well ventilated, and remove contaminated overgarments from the hot line area to avoid buildup of vapor.

mask immediately; and check shelter pressure, door, and power. Replace filters according to SOP and the appropriate operational maintenance manual.

h. Provide SOP Guidance for Shelter Attendants (Guards). Describe operating procedures for shelter attendants and nonshelter personnel, including visitors. Shelters or vans may be collocated with another unit. If so, assign nonshelter personnel as shelter attendants, when possible. Nonshelter personnel are those not essential to the operation of shelter or van mission equipment. The following could be considered for inclusion in the SOP –

- Once an alert has been issued, but before an attack, the shelter attendant monitors for agent presence of agent. After an attack ceases, the attendant periodically monitors outside air.
- Shelter attendants and nonshelter personnel assist in shelter or van operations. They perform such tasks as refueling generators, realigning antennas, and assisting in entry and exist of shelter personnel and visitors.

i. Determine Contaminated Equipment/Expendable Supplies Requirements.

(1) Contaminated equipment and clothing. SOPs provide guidance for disposal of contaminated equipment and clothing. Contaminated equipment and clothing is kept out of the way of entering personnel. This helps avoid confusion and spread of contamination.

(2) Expendable items. The SOP addresses the storage of supplies for certain expendable items in protective shelters or vans. These are for use by individuals entering and leaving the shelter or van, and could include the following:

- Decon materials, such as soap or detergent, bleach, M291 skin decon kits, and water.
- Decon equipment including buckets, rags for wiping, and brushes for scrubbing.
- M256-series detector kits.
- Disposable field-expedient items.
- MOPP gear.
- BDUs in various sizes.
- Batteries.
- Plastic bags, trash cans, and other containers to be used for protecting uncontaminated items.

41. ENTRY AND EXIT PROCEDURES

32. Entry and exit procedures are slow and risky procedures; therefore, the commander must allow only those personnel that are mission essential to enter and exit. Entry and exit procedures for a ship's collective protection is covered in detail in the CBR Defense Bill specific to that ship. Entry and exit procedures for a vehicle or fixed site shelter are specified in unit SOPs. Step-by-step instructions for all systems allow for safe transition from individual to collective protection and back. Entry and exit operations can become high risk, especially those involving allied forces, with different languages, equipment and training.

a. Background.

(1) To illustrate procedures, various possible MOPP gear ensemble combinations can be used to depict procedures for entry and exit from a shelter, entry and exit of armor crews from an armored vehicle, or for entry and exit from a contaminated area. The MOPP gear ensemble may include –

- Ground-personnel IPE - field protective mask with or without hood (based on type of overgarment worn), carrier, helmet with chemical protective cover, individual weapon, armored vest (if worn), and MOPP gear. (See shelter entry/exit instructions for personnel wearing BDO or JSLIST).

- Combat vehicle and aircrew IPE—tank or aircraft mask with or without hood (based on type of overgarment worn), combat vehicle crewman or aircraft crewman helmet, individual weapon, armored vest (if worn), and MOPP gear.(See shelter entrance/exit instructions for individuals with combat vehicles or aircrew ensemble or hatch vehicular system without an airlock).

(2) Each ensemble and type of enclosure have certain characteristics that dictate different steps. Therefore, procedures for a particular option are a composite of general guidelines for individual and collective protection. Entry and exit procedures in this appendix illustrate the necessity to modify procedures based on their application and system configuration. Procedures presented here give steps common to all entry and exit procedures. Actual procedures for a particular system should be more specific. The procedures should be in se are in the system's technical manual, and they should appear in the unit SOP.

b. Entry and Exit Procedures - Collective Protection Shelter with an Airlock.

(1) Selecting Sites. Select a site for shelter erection that is free of liquid contamination. If setting up a shelter where the external agent concentration produces a relative chemical hazard reading of less than one bar on the CAM (indication that no agent is present), entry into the shelter is unlimited. Information on setting up, striking, and operating the shelter is contained in applicable equipment publications.

(2) Presence of Agent. Where the external concentration of agent produces a CAM reading of one bar or more, entries should be discontinued unless they are mission essential. Personnel entering the shelter follow entry instructions when liquid contamination is detected or suspected on their overgarments. Other guidance includes –

- Establish a hot line at least 4 feet from the air lock. Check the floor area between the hot line and the entrance for evidence of liquid contamination. Use both visual check and detector/monitoring equipment.
- Decontaminate this area if contamination is present. Cover it with a plastic sheet, impermeable, or similar material; or find another area if possible.
- Remove overgarments in a room or covered area (if possible) that is separate from the room in which the entrance is located, and establish the hot line at the doorway between the two rooms. Keep the room with the air lock as clean as possible.

(3) Equipment. Allow no equipment to enter the shelter unless it is known to be free of contamination. Pre-position decon kits, alarms, detector kit samplers, and a CAM inside the air lock. These components require periodic replenishment, depending on the frequency of entries. The CAM will require fresh batteries based on technical manual guidance.

(4) Procedures Prior to Entry. If contaminated, all personnel) must be decontaminated before they are permitted entry. Use chemical and radiological detection equipment to check for the presence of contamination on individuals and their equipment; also check for presence of contamination on individual equipment if they are allowed in the shelter.

WARNING

- Always purge the air lock before opening the inner door, if the outer door has been opened.
- When operating in a toxic environment, never open the outer and inner doors of the air locks at the same time.

(5) Entry Procedures can include –

- Personnel remove their MOPP (except their mask), BDUs, and boots outside the air lock. This procedure reduces the amount of possible contamination entering the air lock.
- Personnel check to ensure that the air lock is empty and the inner door is closed.
- Personnel enter the air lock and close the outer door.
- Personnel check for contamination after the air lock is purged. If contaminated, the individual must return to the outside and decontaminate his skin; then return to the air lock and repeat the purge cycle and contamination check. If no contamination is detected, the protective mask is removed and placed in a plastic bag. The plastic bag is sealed and labeled. The individual opens the inner air lock door and enters the shelter; the plastic bag is carried into the shelter with the individual.

(6) Exit Procedures can include –

- Individual checks to ensure that the ambulatory air lock is empty and the outer door is closed.
- Individual enters the air lock and closes the inner door.
- Individual puts on his protective mask, and then exits through the outer door.
- Individual puts on his BDU and boots and then assumes the established MOPP level before departing the immediate area of the exit door.

WARNING
Do not open the outer door until the protective mask has been put on.

c. Entry Procedures - Shelter Entry Instructions for Ground-Troops Ensemble (BDO). It is best to doff (remove) items from top to bottom because upper parts of the ensemble overlap lower parts. This order minimizes contamination transfer. Personnel can perform entry steps with or without assistance from a buddy or shelter attendant. However, personnel can perform some steps more easily and safely with help. Therefore, the buddy system is strongly recommended. Personnel in the ground-troop ensemble should use the following 13 steps:

- Step 1. Use detector paper to determine areas of gross liquid contamination on your equipment and garments. Give special emphasis to these areas, and use field-expedient absorbents, such as sand, dirt, or rags, to remove the gross liquid contamination. Take special care to avoid touching these areas during overgarment doffing.

> **NOTE**
> If a radiological or biological hazard is present, lightly wipe down the overgarment with hot, soapy water prior to entry into the shelter. This will dampen the overgarment and reduce any secondary aerosolization of either radiological or biological contamination while conducting doffing procedures.

- Step 2. Remove load carrying equipment, mask carrier, and helmet before crossing into the shelter. If the hood is worn over the LCE, loosen the hood straps. Remove your M291 and your waterproof bag, and take them with you.
- Step 3. Untie the ankle cords, and open the velcro and zippers of both trouser legs.
- Step 4. Undo rear snaps of jacket. Leaving top snap closed, undo the remaining two front snaps. Untie waist cords, but leave zipper closed.
- Step 5. Undo shoulder straps. Remove them from beneath the arms and reattach them over the shoulder. (Use assistance if possible.) Loosen the neck cord. Decontaminate mask hood with M291 skin decon kit. The M291 decon kit is a single-packet, one-step application. Open the packet, slip fingers into the pad, strap, and decon your mask and hood thoroughly. The M291 can also be used to decontaminate equipment that needs to be taken into the shelter.
    - Step 6. Decontaminate gloves before rolling hood. (Use assistance if possible.) Leave the hood zipper closed. Grasp the hood by the straps and lift the hood off your shoulders and partially off your head until most of the back of your head is exposed. Roll the hood. Start at your chin, making sure the zipper and neck cord are tucked into the roll, and work around the entire mask until the rolled hood will stay up, off your shoulders. Roll the hood tightly against your mask without pulling the hood off the back of your head.

> **NOTE**
> If your assistant is also entering the shelter, steps 1-6 should be performed before proceeding to step 7.

- Step 7. Undo the top jacket snap, and open the jacket zipper. With one hand, pull the sleeve band over your hand without loosening your glove (make a fist if necessary). Remove that arm from the sleeve. Repeat for your other arm. Place jacket away from the entry path.
- Step 8. Stand against a wall or other support for balance, and unsnap and unzip your trousers. (Use assistance if possible.) Pull or have the assistant pull your trousers over the heels of your chemical overboots/GVOs for removal, or "walk" the trousers off. To do this, alternately lift one foot while holding trouser material to the ground with your other foot. Leave the overboots or GVOs on, and place trousers away from the entry path.

> **NOTE**
> Your assistant, if also entering the shelter, should perform steps 7 and 8 now before proceeding to step 9.

- Step 9. **(**Air-lock entry). For a van with air lock go up the steps, and loosen your overboot laces or GVO clasps. Open the door, remove one overboot or GVO at a time, toss it away from the steps, and step into the air lock with your exposed field boot. Do not touch exposed field boots on the exterior platform surface or stairs after removing your overboots or GVOs.

> **NOTE**
> When you are operating an air-lock system in a contaminated environment, the protective entrance and shelter interior must be monitored with detection equipment.

- Step 10. Enter air lock and ensure door is closed. When the low pressure indicator light in the protective entrance (PE) module goes out, rotate the purge time clockwise to its full extent. Do not set the purge time until after the low pressure light goes out.
- Step 11. Decontaminate your gloves again. Then decontaminate the bottom (rolled portion) of your hood. Wait for completion of the purge cycle. When the timer bell sounds, loosen your gloves but do not remove them yet.
- Step 12. Clearing Airlock. A trained operator will use the CAM, if available, to detect and indicate the relative level of chemical agent vapor hazard present on personnel, clothing, or equipment as well as the interior of the PE or shelter. When sampling results are negative, stop breathing (hold your breath), remove your mask

> **WARNING**
> Suspected false positive reading must be verified with other monitoring equipment such as M8/M9 paper and M256 detector kit before proceeding further.

and hood, and place them in your waterproof bag. Remove your gloves and drop them to the floor. Carry the waterproof bag with you.

- Step 13. Enter shelter. Continue to hold breath, **e**nter the shelter and then resume breathing.

WARNING
When entries are performed in a contaminated environment, monitor every 30 minutes. If detector/monitoring shows positive, all personnel should mask until the source of the contamination is located and removed and/or further tests indicate the contamination is no longer a threat.

NOTE: Based on the above procedures, commanders may use the entry processing times in Figure B-1 for planning purposes.

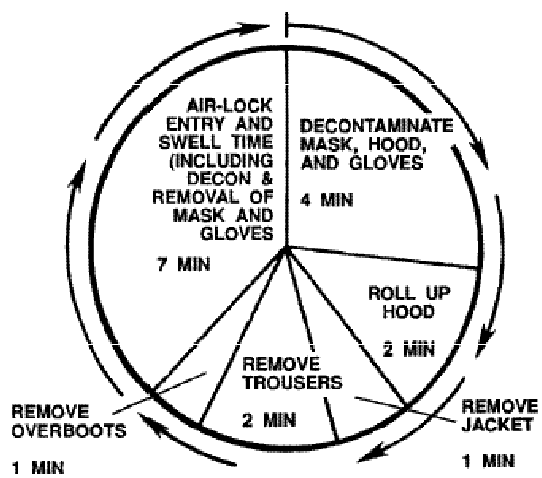


Figure B-1. Entry Process Times

d. Entry Procedures - Shelter Entry Instructions for Ground Troop Ensemble (JSLIST).

Doffing IPE (JSLIST). It is best to doff (remove) items from top to bottom. This order helps to minimize contamination transfer. Personnel should use the 13 steps:

- Step 1. Use detector paper to determine areas of gross liquid contamination on your equipment and garments. Give special emphasis to these areas, and use field-expedient absorbents, such as sand, dirt, or rags, to remove the gross liquid contamination. Take special care to avoid touching those areas during overgarment doffing.

> **NOTE**
>
> If a radiological or biological hazard is present, lightly wipe down the overgarment with hot, soapy water prior to entry into the shelter. This will dampen the overgarment and reduce any secondary aerosolization of either radiological or biological contamination while conducting doffing.

- Step 2. Remove LCE, mask carrier, and helmet before crossing into the shelter. Remove IEDK and your waterproof bag, and take them with you.

> **NOTE**
>
> If the JSLIST is worn, the mask will not have a hood attached.

- Step 3. Unfasten the hook-and-pile fasteners at the wrist and ankles. Untie bow in coat and retention cord (if tied), unfasten webbing strip snap and allow waist coat retention cord loop to retract. Touching only the outside surfaces of the coat, loosen the bottom of the coat by pulling the material at the bottom of the coat away from the body. Locate trouser suspender snap couplers by feeling the outside of the coat. After locating snap couplers squeeze couplers to release suspenders.

> NOTE
>
> Avoid touching the throat area. If the JSLIST is worn, pull the overgarment hood over protective mask and secure according to TM 10-8415-220-10.

- Step 4. (Use assistant if possible.) Decontaminate your mask using your M291. Take special care to decontaminate the eyelens, faceblank, barrel locks and front edge of hood. Individual or assistant if used will decontaminate his/her gloves. Unfasten barrel locks and loosen drawcords. NOTE: Use M291 to decontaminate any equipment you take into the shelter.

> **NOTE**
>
> Use M291 to decontaminate any equipment you take into the shelter.

- Step 5. Unfasten front closure hook-and-pile fastener tape at the chin down to your chest; pull slide fastener down to the chest area.

> **WARNING**
>
> Use IEDK to decontaminate any equipment you will take into the shelter.

- Step 6. (Use assistant if possible.) Grasp hood by the outside surface near each barrel lock, lift hood up off head and reverse roll the hood one time while pulling hood towards the back of the head to remove. If assistance is available use procedures outlined in FM 3-5, MOPP Gear Exchange to remove hood.

> **NOTE**
>
> If your assistant is entering the shelter, perform steps 1-6 before proceeding to step 7

- Step 7. Unfasten front closure hook-and-pile tape and slide fastener from the chest down to the bottom of the coat. Individual grasps the front of the coat and pulls the coat back until it is off his shoulders. He then extends his arms behind his back and works his arms out of the sleeves. Move the coat away from entry path.
- Step 8. Unfasten hook-and-pile fastener tapes on waistband of trousers. Unfasten the two front closure snaps and open fly slide fastener. Grasp trousers at the hips; pull trousers down to knees (Use assistant if possible.). Pull or have assistant pull the trousers over the heels of the boots for removal or walk trouser off by alternately lifting one foot while holding trouser material to the ground with your other foot. Leave boots on. Move trousers away from entry path.

> **NOTE**
>
> If your assistant is entering the shelter, perform steps 7 and 8 before proceeding to step 9

- Step 9. Air-lock entry. Ground-based shelter with air-lock entry is not applicable to the patriot missile system. For a van with air lock go up the steps, and unfasten the two strap buckles on the MULOs or unfasten the clasps on the BVOs/GVOs. Open the door, remove one MULO or overboot at a time, toss it away from the steps, and step into the air lock with your exposed combat boot. Do not touch exposed field boots on the exterior platform surface or stairs after removing your MULOs or BVO/GVO.

> **NOTE**
>
> When you are operating an air-lock system in a contaminated environment, the protective entrance and shelter interior must be monitored with detection equipment

- Step 10. Enter air-lock and ensure door is closed. When the low-pressure light in the PE module goes out, rotate the purge time clockwise to its full extent. Do not set the purge time until after the low pressure light goes out.
- Step 11. Decontaminate your gloves again. Wait for completion of the purge cycle. When the timer bell sounds, loosen your gloves but do not remove them.
- Step 12. A trained operator will use the CAM, if available, to detect and indicate the relative level of agent vapor hazard present on personnel, clothing, or equipment as well as the interior of the PE/shelter. When sampling results are negative, stop breathing (hold your breath), remove your mask, and place it in your waterproof bag. Remove your gloves and drop them to the floor. Carry the waterproof bag with you.

WARNING

Suspected false positive reading must be verified with other monitoring equipment such as M8/M9 paper and M256 detector kit before proceeding further.

- Step 13. Enter the shelter and resume breathing.

WARNING

When entries are performed in a contaminated environment, monitor every 30 minutes. If detector/monitoring shows positive, all personnel should mask until the source of the contamination is located and removed and/or further tests indicate the contamination is no longer a threat.

e. Shelter Exit Instructions for Ground-Troop Ensemble. Overgarment donning procedures for exiting the shelter are less time-consuming and risky than doffing procedures. Whenever possible, ensure replacement or spare overgarments are pre-positioned inside the shelter. For systems with a high rate of entry and exit, commanders must provide for periodic resupply of spare overgarments. Personnel should follow these four steps-

- Step 1: Put on clean overgarments, overboots, and gloves inside the shelter.
- Step 2: Check the compartment control module (CCM) to ensure the air lock is unoccupied. Stop breathing, and step into the entrance taking your waterproof bag with you.

- Step 3: Open the waterproof bag, remove your mask by the straps with one hand, and make sure the hood is inside out over the front. Place your mask to your chin and face, and pull the head harness over your head. Tighten cheek straps, clear and seal your mask, and resume breathing. Unroll the hood. Pull the hood over your head, and tighten the neck cord.
    - Step 4: Exit the air lock and ensure the PE door is fully closed after exiting.

f. Shelter Entrance Instructions (Doffing IPE) - Shelter Entrance Instructions for Individuals with Combat Vehicle and Aircrew Ensemble. Use of the combat vehicle crewman mask or aircraft crewman helmet with a different mask configuration requires differences in removing and handling the hood. The microphone cord hangs down to the shoulders. It can transfer contamination if not secured to the helmet in some way. The microphone boom must be tucked in well against the helmet; otherwise, it snags the hood. In addition, the main power cord extends beyond the hood. If contaminated, it will be very difficult to decontaminate. To avoid these problems, personnel should use the following four steps:

- Step 1. If you wear your vehicle helmet underneath your hood, the first step is to remove the hood (from back to front) from your helmet, remove it from around the eye lenses and then from the filter hose. If you wear your hood underneath your helmet, remove your helmet first, and then remove the hood from your mask in the manner described.

WARNING

Do not touch the eye lens area or the canister hose. These are difficult to decontaminate and are potential transfer hazards.

- Step 2. With mask and helmet (if applicable) still on, remove your overgarment jacket and trousers. Use the same basic procedures outlined for personnel in the ground-troop ensemble, with one exception. When performing the doffing procedure, bend at your waist to prevent the filter canister and hose from touching you when your overgarment is being removed.

- Step 3. Proceed to the air lock or hot line. Remove boots as you step into the air lock.
- Step 4. Just before entering the protective enclosure, remove your mask, helmet, and gloves. Seal your mask inside your waterproof bag and enter the enclosure.

> **NOTE**
>
> For systems without an air lock, remove your mask, helmet, and gloves only after tests indicate the absence of vapor. Place your mask inside your mask waterproof bag and seal the bag.

g. Shelter Exit Instructions for Personnel with Combat Vehicles and Aircrew Ensemble (Donning IPE).Overgarment donning procedures for exiting the shelter are less time-consuming and risky than doffing procedures. Whenever possible, ensure replacement or spare overgarments are pre-positioned inside the shelter. For systems with a high rate of entry and exit, commanders must provide for periodic resupply of spare overgarments. Personnel should follow these three steps:

- Step 1. Put on clean overgarment, overboots or GVOs, and gloves inside the shelter.
- Step 2. Check to ensure the air lock is unoccupied. Stop breathing, and step into the entrance, taking your waterproof bag with you.
- Step 3. Open the waterproof bag, don mask, and put on gloves.

> NOTE
>
> For systems without an air lock, all personnel don MOPP gear before anyone exits the protective enclosure. After the exit, those remaining reseal and purge the enclosure. When vapor contamination drops below detection levels, the remaining personnel can follow unmasking procedures.

h. Hatch Vehicular System without an Air Lock- Entry/Exit Guidance. These procedures are for entering and exiting a combat fighting vehicle in an NBC environment. These procedures can be modified for shelters without an air lock. Before exiting for mission-essential tasks, personnel should don their SCALP or expedient protective clothing if available, such as wet weather gear over their MOPP gear. When they complete the tasks, they should remove any expedient protective clothing in a top-to-bottom sequence. They must avoid touching clean overgarments with the cover exterior. If heavy liquid contamination is present and/or additional overgarments are available, personnel must perform two doffing procedures—one for the cover and one for the overgarment. Entry and exit procedures detailed here assume the following conditions:

- Vehicle exterior is contaminated.
- Crew is operating “buttoned up” with the NBC overpressure system on.
- Crew is wearing all protective clothing (except mask and gloves).
- Exit is for a mission-essential task, such as corrective maintenance.
- Overpressure system remains on throughout the exit and entry cycle.
- Tactical situation is relatively safe, such as in rearming and/or refueling operations.
- The vehicle is not under fire.
- Contact with the enemy is unlikely.
- Immediate movement is not anticipated.

(1) Entry Instructions. If you are the loader on an armored fighting vehicle, perform steps 1 through 8. If you are not the loader, when the loader completes step 8, perform step 1 and then steps 4 through 8. If you are the last individual in, close the hatch. With hatch closed, the crew performs steps 9 through 12.

- Step 1. Mount the vehicle over the left front road wheel.
- Step 2. Decontaminate the hatches and area around the hatch (approximately 4 feet in diameter) using either the M 11 or M13 DAP. Acquire the water can from the left bustle rack.
- Step 3. After the required stand time, flush the decontaminant from the loader’s hatch and surrounding area.
- Step 4. Stand next to the loader’s hatch and remove any field-expedient protective items or wet weather gear jacket. Take care not to touch the exterior of any field-expedient protective clothing items, wet weather gear, or gloves. Discard the removed items over the side.
- Step 5. Loosen the rain trousers, if worn. Roll them with clean side out while pulling them down to your ankles. Do not allow the contaminated side of field-expedient protective clothing items, or rain gear, or the contaminated gloves to touch your overgarment. Discard rain trousers over the side.

- Step 6. Lift one foot and remove the boot cover. Discard it over the side of the vehicle, and place that foot with exposed boot inside the decontaminated area. Repeat this procedure for your other foot.
- Step 7. Decontaminate your gloves with your personal decon kit.
- Step 8. Lower yourself into the vehicle.
- Step 9. Resume operations as if in a contaminated environment.
- Step 10. After a purge cycle and as the tactical situation permits, monitor the interior. A crew member should begin sampling with detector/monitoring equipment.
- Step 11. If detector results are negative, proceed with unmasking procedures. If no symptoms appear, remove masks and gloves at the vehicle commander's order. Operate in the normal overpressure buttoned-up mode.
- Step 12. If detector results continue positive, remain in MOPP gear. You must remain protected until the mission is complete and further decon can be performed or until further tests are negative.

(2) Exit Instructions. In order to safely exit the vehicle, the following steps should be carefully followed:

- Step 1. Traverse the turret until the main gun is centered over the front slope.
- Step 2. Put on mask and protective gloves.
- Step 3. If you are the loader, perform exit before any crew member begins. Put on the SCALP or either a field-expedient protective clothing item or rain gear and boot covers. Carrying your personal decon kit, exit through the loader's hatch.
- Step 4. If you are not the loader, but are required to exit, move to the loader's station. Put on the SCALP or a field-expedient protective clothing item or rain gear and boot covers. Carry your personal decon kit and exit through the loader's hatch. If you are the last to exit, carry the decon apparatus and close the hatch.
- Step 5. If you are the loader, determine if the vehicle and surrounding area are contaminated.

> **NOTE**
>
> Follow procedures for detecting the presence of chemical agents. For hasty identification, the loader should use M8/M9 chemical agent detector paper for suspected liquid agents. The vehicle commander can use detector/monitoring equipment to detect any vapor agents. If the need to exit the vehicle is urgent, skip this time-consuming step and assume the area is contaminated.

- Step 6. If no contamination is present, crew may reduce their MOPP level and perform step 7. If detector/monitoring equipment detect any contamination is present, decontaminate the loader's hatch and an area approximately 4 feet in diameter around it.
- Step 7. Perform the task(s) that dictated the exit.

i. Exit. Instructions for Personnel to Enter an Open Air Toxic Free Area (Doffing Procedures). Personnel who transition from a contaminated area to an open air toxic free area follow a deliberate process to ensure no transfer of contamination. Table B-1 outlines the procedures for processing of personnel into an open air TFA.

Table B-1. CCA Processing Steps to Enter a Open Air TFA

CCA PROCESSING STEPS	BDO	CPO	JFIRE	EOD LEVEL A	ATTENDANT
STATION 1					
Arrival and Initial Decontamination Area					

1. Split into two person “buddy” teams. (NOTE: Try to team with an inividual wearing the same protective overgarment).	*	*	*	*	
2. Check each other for visual evidence or signs of contact hazard (liquid, solid, or dusty). (NOTE: Special interest should be given to gloves, hood/mask, and M9 paper).	*	*	*	*	
3. Disconnect velcro for hose/canister and allow to hang freely. (WARNING: Using two fingers apply pressure to the mask front voicemitter and to the beard of the JFIRE to hold the mask firmly in place and prevent loss of mask seal integrity).			*		
4. Thoroughly decontaminate yourself and all exterior equipment, including your weapon, using the M295 decontamination kit provided. Buddies should assist each other in hard to reach areas. Special interest should be given to gloves, hood/mask, and filter canisters.	*	*	*		
5. Discard used M295 decontamination kits into the trash hamper.					
6. EOD buddy teams will spray the 5 percent chlorine solution, using the multipurpose sprayer (pump pressurized) to all exposed areas of the Level A suit.	*	*	*		
7. Proceed to the “<u>weapons clearing, wash and holding area</u>”.				*	
Weapons Clearing, Wash and Holding Area					
1. Complete weapons clearing/turn in (if required) prior to decontaminating gloves and overboots.	*	*	*	*	
2. Step into boot wash tray.	*	*	*		
3. Wash gloves in decontaminating tub.					
4. Rinse gloves in rinse tub.	*	*	*	*	
5. If a holding area is not established, proceed directly to the “<u>equipment removal area</u>”.	*	*	*	*	
	*	*	*	*	
	*	*	*		

Table B-1. CCA Processing Steps to Enter a Open Air TFA (Continued)

CCA PROCESSING STEPS	BDO	CPO	JFIRE	EOD LEVEL A	ATTENDANT

STATION 1					
Holding Area					
NOTE: EOD personnel wearing Level A Suits will proceed directly to Station 3 – Overboot removal area. Decontaminate boots in foot trays provided along the way.				*	
The holding area is designed to allow shade for personnel waiting to process. Informational signs may be developed for personnel to read while waiting. This is a location to post installation specific information. The following is general information that could be posted within the area.					
1. Carefully read the notices posted on the information boards prior to beginning your processing.					
2. Remove your individual protective equipment (IPE) in the order specified by the posted instructions.					
3. In the event CCA/TFA complex comes under attack or is otherwise compromised, immediately take cover, and don your protective mask and gloves.					
4. Discard used M295 decontamination kits into the trash hamper.					
External Equipment Removal Area					
NOTE: **WARNING**: Take care when doffing items. Do not remove mask or any protective clothing. Contact hazard transfer to exposed skin and/or the respiratory tract can lead to sickness or death.					
1. Undo the velcro attachments on your hood underarm straps.					
2. Re-attach underarm straps over the shoulder.	*				
3. Remove all external items other than protective mask and overgarment and place on racks. These items include helmet, vest (aircrew), web gear, mask carrier, flak vest, cold/wet weather gear and other nonessential items. (NOTE: Important-Do not let previously deconned equipment touch the ground).	* *	*	*		
4. Empty all pockets and place items in hampers.					
5. Proceed to station 2- Mask wipe and hood removal area.					
6. Decontaminate boots in foot trays provided along the way.	*	*	*		
	*	*	*		

Table B-1. CCA Processing Steps to Enter a Open Air TFA (Continued)

CCA PROCESSING STEPS	BDO	CPO	JFIRE	EOD LEVEL A	ATTENDANT
STATION 2					
Mask Wipe and Hood Removal Area					*
NOTE: **WARNING**: Using two fingers apply pressure to the mask fron voicemitter and to the beard of the JFIRE to hold the mask firmly in place and prevent loss of mask seal integrity.					
Individual Will:					
1. Face the attendant and apply pressure to the front voicemitter. "Firefighters will hold mask in place with two fingers on the beard/breathing valve".	*	*	* *		
Attendant Will:					
1. Loosen processee's hood drawstring.	*				
2. Re-attach underarm straps over the shoulder (if not already completed).	*				
3. Wipe down eyelens outserts and around the filter element using the 5% chlorine solution.	*	*			
4. Wipe all exposed areas of the interspiro CW mask (lens and canister) with the 5% chlorine solution.		*			
5. Repeat wipe down procedure with water.					
6. Pull hood over processee's head and unsnap hood straps with pliers. (Cut the hood temple straps if necessary)	*	*	*		
7. Pull the hood off the mask and drop it in the hamper.	*				
Attendant and Individual Will:					
1. Decontaminate and rinse gloves in tubs provided.	*				
Individual Will:					
1. Proceed to Station 3 – Overboot removal area.	*	*	*		
NOTE: **IMPORTANT**: JFIRE personnel proceed directly to Station 3-Protective Overgarment Removal Area.	*	*	* *		

Table B-1. CCA Processing Steps to Enter a Open Air TFA (Continued)

CCA PROCESSING STEPS	BDO	CPO	JFIRE	EOD LEVEL A	ATTENDANT
STATION 3					
Overboot Removal Area					
NOTE: **WARNING**: While waiting in line, read all instructions for this station and watch other processing teams in front of you.					
1. Proceed to the first available bench as a buddy team, sit on the bench with boots resting on the "dirty" side of the bench.	*	*		*	
2. Undo both of your Velcro pant leg fasteners and unzip leg zippers.	*	*		*	
3. Undo all overboot fasteners.	*	*		*	
4. The outer pant leg of the Level-A suit is pulled up to fully expose the bunker boots.				*	
5. One individual will lift their leg closest to the center of the bench and rests it on the bench as your buddy removes the overboot/bunker boot and drops it into the hamper. Once the overboot/bunker boot is removed place your foot on the clean of the bench as you now straddle the bench.	*	*		*	
6. The other individual will complete the same procedures until both processees are straddling the bench.	*	*		*	
7. Utilizing the "Buddy" system the remaining boot is processed in the same manner.	*	*		*	
8. Wipe down bench with 5% chlorine solution.	*	*		*	
9. Decontaminate and rinse gloves in tubs provided and proceed to the "Protective Overgarment Removal Area".	*	*		*	
Protective Overgarment Removal Area					

NOTE: **IMPORTANT**: Working is as a buddy team, remove the overgarment, bunker pants or level A suit. One processee will perform the procedure first then the buddy will perform it next. 1. Battledress Overgarment (BDO). a. BDO Trouser Removal: Buddy Will: • straps and unfasten front fly closure. Individual Will: •	* *				

Table B-1. CCA Processing Steps to Enter a Open Air TFA (Continued)

CCA PROCESSING STEPS	BDO	CPO	JFIRE	EOD LEVEL A	ATTENDANT
STATION 3					
Protective Overgarment Removal Area (Continued)					

a. BDO Trouser Removal: (Continued)					
Buddy Will:					
• Lower the individual's BDO trousers to their knees. **NOTE**: Do not turn BDO trousers inside out as you remove them.	*				
Individual Will:					
• Steady themselves by holding on to the rack and extend their foot back one at a time.	*				
Buddy Will:					
• containment hamper.	*				
Individual and Buddy Will:					
• Decontaminate and rinse gloves in tubs provided.	*				
• Repeat procedures for doffing buddy.	*				
b. BDO Jacket Removal:					
Buddy Will:	*				
• Loosen zippers, velcro fasteners, and untie the drawstring on the front of the jacket.	*				
• Undo velcro attachment points on each sleeve cuff.					
Individual Will:	*				
• Turn and face away from your buddy, make a fist with both hands and hold arms behind you.	*				
Buddy Will:					
• Pull the jacket down and away from the individual's shoulders helping them remove their arms from the sleeves one at a time. For elastic sleeve cuffs the jacket comes off inside out. For velcro jackets, the jacket will come off right-side out.					

Table B-1. CCA Processing Steps to Enter a Open Air TFA (Continued)

CCA PROCESSING STEPS	BDO	CPO	JFIRE	EOD LEVEL A	ATTENDANT
STATION 3					

b. BDO Jacket Removal:					
<u>Buddy Will</u>: (Continued)					
• Place jacket in the containment hamper.	*				
<u>Individual and Buddy Will</u>:					
• Decontaminate and rinse gloves in tubs provided.	*				
• Repeat the jacket removal steps for the doffing buddy and proceed to Station 4 – Glove Removal Area.	*				
2. JFIRE. Bunker Trousers and CPO Trouser Removal:					
<u>Firefighter 1 Will</u>:					
• Push bunker pants down to the top of the bunker boots.			*		
• Reach through the CPO jacket and “pinch” hasp to **release** suspenders.			*		
<u>Firefighter 2 Will</u>:					
• Unsnap and untie the waist elastic coat retention cord.			*		
• Unfasten the waistband hook and pile fastener tapes and front fly closures.			*		
<u>Firefighter 1 Will</u>:					
• Turn and face away from Firefighter 2.			*		
• Steady yourself by holding on to the rack. Extend your foot back one at a time.			*		
<u>Firefighter 2 Will</u>:					
• Remove the bunker trouser, boot and CPO trouser at the same time and place them into the containment hamper.			*		
• Place a uncontaminated disposable plastic boot or sock on the foot before touching the ground.			*		
• Repeat the process for the other leg.			*		

Table B-1. CCA Processing Steps to Enter a Open Air TFA (Continued)

CCA PROCESSING STEPS	BDO	CPO	JFIRE	EOD LEVEL A	ATTENDANT
STATION 3					
Protective Overgarment Removal Area (Continued)					

2. JFIRE. Bunker Trousers and CPO Trouser Removal: (Continued)					
Firefighter 1 Will:					
• Repeat this process for your buddy.			*		
Both Firefighters Will:					
• Decontaminate and rinse gloves in tubs provided. Note: Firefighters will remove CPO jacket according to CPO removal procedures below.			*		
3. CPO					
a. CPO Trouser Removal.					
Individual Will:		*			
• Reach through your jacket and "pinch" hasp to release suspenders.					
Buddy Will:		*			
• Unsnap and untie the waist elastic coat retention cord.		*			
• Unfasten the waistband hook and pile fastener tapes and front fly closures.		*			
Individual Will:					
• Turn and face away from their buddy.		*			
Buddy Will:		*			
• Lower the individual's trousers to their knees. **NOTE**: Do not turn trousers inside out as you remove them.		*			
Individual Will:					
• Steady themselves by holding on to the rack. Extend your foot back one at a time.		*			
Buddy Will:					
• Remove the individual's trousers and place them into the containment hamper.					

Table B-1. CCA Processing Steps to Enter a Open Air TFA (Continued)

CCA PROCESSING STEPS	BDO	CPO	JFIRE	EOD LEVEL A	ATTENDANT
STATION 3					
Protective Overgarment Removal Area (Continued)					

a. CPO Trouser Removal: (Continued)					
Individual and Buddy Will:					
• Decontaminate and rinse gloves in tubs provided.		*			
• Repeat procedures for doffing buddy.		*			
b. CPO Jacket Removal:			*		
• Firefighter 2 will disconnect the canister and hose assembly and secure it away from the CPO jacket.		*	*		
• Your buddy will loosen zippers, and hook and pile tape on the front of the jacket, the jacket sleeves and the hood.		*	*		
• Turn and face your buddy; Lean slightly forward with chin out and head up.		* *	* *		
• Your buddy will stretch CPO hood out and pull back away from your head.		*	*		
• Turn and face away from your buddy, make a fist with both hands and hold arms behind you.		*	*		
• Your buddy will pull the jacket down and away from your shoulders helping the processee remove their arms from the sleeves one at a time.		*	*		
NOTE: Your arms should come out of the coat without turning the sleeves inside out.		*	*		
• Place jacket in the containment hamper.		* *	* *		
Individual and Buddy Will:					
• Decontaminate and rinse gloves in tubs provided.				*	
• Repeat all above procedures for doffing buddy.					
• Proceed to Station 4 - Glove Removal Area.					
4. EOD – HAZMAT Level A Suite:					
NOTE: **IMPORTANT**: Each of the following steps requires the assistance of your buddy.					
a. Unfasten the belt inside your suit and don your gloves. Note: The gloves are stored inside the level A suit.					

1 **Table B-1. CCA Processing Steps to Enter a Open Air TFA (Continued)**

CCA PROCESSING STEPS	BDO	CPO	JFIRE	EOD LEVEL A	ATTENDANT
STATION 3					
Protective Overgarment Removal Area (Continued)					
4. EOD – HAZMAT Level A Suite: (Continued)					
b. Open the velcro closure and zipper.					
c. Pull the suit down to knee level ensuring the outside of the suit does not contact the uniform or skin in the process.				*	
d. Remove the suit one leg at a time by lifting your leg backward and pulling it free from the leg and foot.				*	
e. Decontaminate and rinse your gloves in tubs provided and place a noncontaminated disposable plastic sock or boot on the exposed foot before it touches the ground.				* *	
NOTE: Once the suit is unzipped, you may switch the CW interspiro mask from bottled air to ambient air.					
f. Place the suit in the hamper.					
g. Processee and buddy will decontaminate and rinse gloves in tubs provided and proceed to Station 4 - Glove Removal Area.				* * *	
STATION 4					
Glove Removal Area					
NOTE: **WARNING**: Avoid contact with the outside of your rubber glove with your unprotected hands.					
1. Work both rubber gloves at the same time and drop into hamper.	*	*	*	*	
2. Work the Fire/CW protective gloves at the same time until they are halfway off and drop into hamper.			*		
3. Proceed to the Mask Monitoring/Removal Area.	*	*	*	*	

1

Table B-1. CCA Processing Steps to Enter a Open Air TFA (Continued)

CCA PROCESSING STEPS	BDO	CPO	JFIRE	EOD LEVEL A	ATTENDANT
STATION 4					
Mask Monitoring Removal Area					1

NOTE: **WARNING**: Avoid contact with the outside of your rubber glove with your unprotected hands.					
Individual Will:					
• Face the attendant, spread legs apart and hold arms out to your side with your palms up.	*	*	*	*	
VHA Attendant Will:					
1. Monitor individual using the CAM. (See procedures below).	*	*	*	*	
2. If CAM bar readings are less than the CAM Monitoring Chart, the individual will remove their mask according to the mask removal procedures below.	*	*	*	*	
3. If CAM bar readings are equal or greater to what is listed in the CAM Monitoring Chart , the individual will don clean gloves and proceed to the uniform/undergarment removal area.	*	*	*	*	
CAM Monitoring Area:					
1. Monitor the front of the processee outlining the body and across the front using an X pattern if desired.	*	*	*	*	
2. Have the processee face away and extend their foot back one at a time and monitor the bottom of each foot.	*	*	*	*	
3. During monitoring pay special attention to the palms, wrists, ankles, neck, and bottom of feet.	*	*	*	*	
Mask Removal Procedures:					
NOTE: **IMPORTANT**: The attendant will document the individuals name and Social Security Number (SSN) on a mask ID tag before the individual removes the mask.					
Attendant Will:					
1. Ask the individual their name and SSN and write it on the mask tag.	*	*			
2. Bring nomex hood over processee's head.			*		
Individual Will:					
1. Using both hands, grasp lower headharness straps, take three deep breaths, holding the last one.	*	*	*	*	

Table B-1. CCA Processing Steps to Enter a Open Air TFA (Continued)

CCA PROCESSING STEPS	BDO	CPO	JFIRE	EOD LEVEL A	ATTENDANT
STATION 4					
Mask Monitoring Removal Area					
<u>Mask Removal Procedures</u>: (Continued)					
<u>Individual Will</u>:					
2. Pull mask out and away from face, remove mask and place on table.	*	*	*	*	
<u>Attendant Will</u>:					
• Attach the mask tag to the headharness buckle and place the mask in the container.	*	*	*	*	
<u>Individual Will</u>:					
• Continue holding breath, eyes open until reaching the Toxic Free Area.	*	*	*	*	
Uniform/Undergarment Removal Area					
<u>NOTE</u>: <u>CAUTION</u>: Bending too far forward in the mask may cause the seal of the mask to leak on some individuals. Use the boot step to elevate your foot when untying the combat bootlaces.					
1. Place foot on boot step and untie combat boots.					
2. Hold onto the rack for balance and remove combat boots, or disposable booties. You may use the boot remover if you desire.	*	*	*	*	
3. Remove your BDU shirt and place it into the hamper.	*	*	*	*	
4. Remove your BDU trousers and place it into the hamper.	*	*	*	*	
5. Return to the Mask Monitoring/Removal Area.	*	*	*	*	
<u>Emergency CCA Procedures</u>:					
If CAM bar readings are the same upon remonitoring, take the following emergency steps:	*	*	*	*	
1. Immediately stop CCA operations.					
2. Monitor surrounding area within the VHA to verify levels and look for any potential hot spots.					

1

Table B-1. CCA Processing Steps to Enter a Open Air TFA (Continued)

CCA PROCESSING STEPS	BDO	CPO	JFIRE	EOD LEVEL A	ATTENDANT
STATION 4					
Uniform/Undergarment Removal Area					
Emergency CCA Procedures: (Continued) 3. If hot spots are found decontaminate by using decontamination kits, washing down area with 5% chlorine solution, sealing, removing, covering etc. 4. Once levels are below the ones listed in the CAM Monitoring Chart, continue CCA operations. 5. If levels have not changed: • Check serviceability of CAMs. Replace as necessary and remonitor area. • Verify wind direction. Ensure you are still downwind or crosswind. If not, the CCA must be relocated to an upwind or crosswind location.					
CAM Monitoring – Risk Matrix Chart: **CAM SCALE** / **CAM BAR READING** H: 3 or more bars (Do not remove protective mask) G: 1 or more bars (Do not remove protective mask)					

42. WARTIME SHELTER PREPARATION AND OPERATION

a. Shelter Organization and Operation. The commander exercises normal command and control over forces in shelters to ensure personnel are available to continue the wartime mission. A shelter command structure should reflect the typical unit command structure. The same personnel who perform these functions during peacetime should continue their duties during wartime shelter operations. The shelter preparation and organization involves designating shelter management teams; preparing for collection and warning; understanding pre-trans and post-attack recovery actions; understanding CCA operations, and making provisions for disposition of IPE. For example:

- The owning organization commander is the commander for all organizational shelters.
- The owning organization first sergeant is the administrative first sergeant for all organizational shelters.

b. Shelter Management Teams (SMT). Teams are pre-identified by the unit commander for each shelter and perform the following functions –

- Operate the shelter.
- Select shelterees to perform shelter operational tasks.
- Control entry, exit, and internal shelteree location.
- Monitor for NBC contamination.
- Brief personnel egressing the shelter into a contaminated environment on the effects of contamination and exposure limits.
- Perform immediate decontamination.
- If appropriate, establish a CCA and TFA for each shelter.
- Establish radiological exposure control procedures for each shelter, if the threat warrants.
- Perform detection and measurement of gamma radiation and chemical warfare agents.
- Determine if contamination is present inside and immediately outside the shelter.

c. Pre-attack Actions. Units and SMTs should –

- Recall shelter teams and activate shelters.
- Improve shelter survivability both inside and out.
- Recall personnel not performing mission critical tasks to their assigned shelter at the proper readiness stage.

d. Trans-attack Actions. SMTs should –

- Suspend shelter in and out processing and secure doors.
- Instruct personnel to take whatever cover is available.
- Instruct personnel to don IPE items if required.
- Monitor overpressure and filtration systems for damage, when applicable.

- Monitor for contamination.

e. Post-attack Actions. SMTs should –

- Check for damage, unexploded ordnance, casualties, and contamination.
- Implement radiological exposure control procedures for a nuclear/radiological hazard.
- Initiate decontamination procedures for people, supplies, and equipment entering the shelter.
- Implement contamination control/avoidance procedures for all personnel performing outside mission essential tasks.
- Wear IPE as directed by the commander.

f. Shelter Equipment. Each shelter should have a shelter kit. Contents may vary; however, each kit should have –

- First aid kit sufficient for the expected number of shelterees and their likely medical needs.
- Floor plan identifying preplanned areas and emergency utility shut off locations.
- Base grid map with medical facilities, shelters, control centers, and key phone numbers indicated.
- SMT identification devices (e.g., badge or armband).
- Operational manuals for the shelter system, other support equipment, and specialized equipment.
- Shelter directives and operational checklists to cover all shelter operation aspects.

g. CCA Operations. CCAs can be part of a shelter or they can be of the open air variety. CCAs are essential to sustained operations in a NBC environment. They limit the spread of contamination into a TFA so personnel can work or obtain rest and relief without wearing IPE. They also provide a controlled environment to safely remove contaminated IPE. CCA operations address –

- Developing procedures and checklists for assistants and signs for processing personnel.
- Obtaining supplies and equipment for stocking and resupply.
- Placing shelter and CCA supplies and equipment susceptible to contamination under covers.
- Processing personnel and material through a CCA before entering a designated TFA.

- Decontaminating IPE (except the overgarment) as soon as practical after contamination occurs.
- Considering all IPE worn when liquid contamination is present as contaminated.
- Bagging and removing liquid contaminated IPE and waste from the CCA as soon as possible to reduce vapor levels. Also bag and remove trash from shelters.

h. IPE Disposition. Process contaminated IPE according to overgarment technical order/manual instructions. CCA personnel should –

- Prepare serviceable protective masks for reuse.
- Discard contaminated permeable IPE.
- Retain other equipment, not addressed above, for reuse.

i. Checklist and Sign Requirements. (Checklist Requirements). In most cases, checklists should be specific enough to allow an untrained person to accomplish all needed actions. Checklists may address –

- Casualty Care Tasks. Establish a first aid and buddy care capability for the shelter.
- Security Tasks. Secure all points of entry or exit when the shelter is operational. Use only one entrance and exit.
- Fire Control Tasks. Inspect the shelter each shift to identify potential fire sources.
- Supply Tasks. Coordinate consumable resupply with the control center responsible for the consumables.
- Subsistence Tasks.
- Administrative Tasks. Keep an events log from the time the shelter is activated until deactivation.
- Mortuary Tasks (see Joint Pub 4-01.7).
- Sleeping Tasks. Plan for and operate a sleeping area for the shelter.

43. CLASSES OF SITE COLLECTIVE PROTECTIVE AND ASSOCIATED PROTECTIVE EQUIPMENT

a. Classes of Fixed Site Collective Protection. For fixed site collective protection facilities, classes of protection (Class I-III) are defined according to the degree of protection provided.

(1) Class I – Pressurized Shelters. Pressurized, fully integrated shelters provide active protection. These systems have high efficiency air filtration and positive pressure (overpressure) systems. Dampers control ventilation openings automatically. These facilities require a Contamination Control Area (CCA), and a purging airlock to accommodate mission-required entries and exits. The protection afforded by a pressurized shelter is dependent upon the filter capacity to remove agents. Class I facilities are divided into four sub-classes:

- Class I-A, Fully Integrated. This sub-class includes buildings constructed tightly enough to integrate collective protection with maximum efficiency. Due to its construction, installed equipment can maintain facility design temperature. The CCA can be integral or can be located outside. Figure B-2 depicts a typical building that would lend itself to a fully integrated system.

Figure B-2. Typical Class I-A Building

- Class I-B, Partially Integrated. This sub-class, for standby systems, involves permanent modifications such as ductwork, and sealing to all or part of a facility. Heating and cooling must be upgraded. The CCA may be installed inside permanently or located outside. Figure B-3 illustrates a typical building where more extensive modifications would be required due to its size and design.

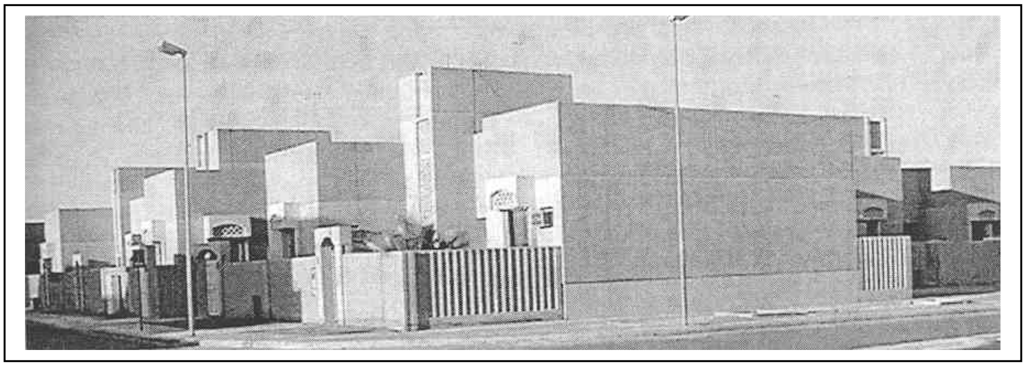


Figure B-3. Typical Class I-B Building

- Class I-C, Expedient. For standby systems, selected portions of the building are sealed by temporary measures such as plastic sheeting and tape. Transportable filter units are temporarily mounted to the building. Heating/cooling may or may not be employed, and a temporary CCA would need to be established. (see Figure B-4).

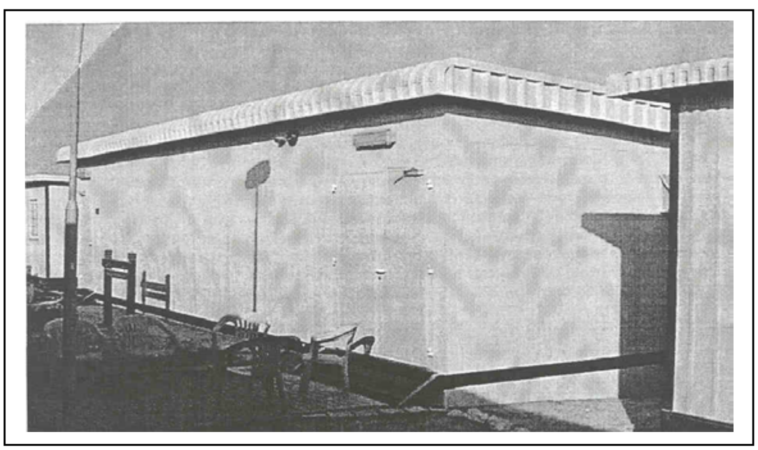


Figure B-4. Typical Class I-C Building

- Class I-D, Secondary Enclosure. Class 1-D enclosures can be used for temporary protection, where the buildings are not suitable for sealing, but suitable for use of portable internal enclosure or liner systems such as the M28 or M20 collective protection equipment. Such application allows for use of existing facilities and auxillary heating and cooling systems. See Figure B-5 which depicts use of the M20 Simplified Collective Protection Equipment (SCPE), which can be installed in an existing structure.

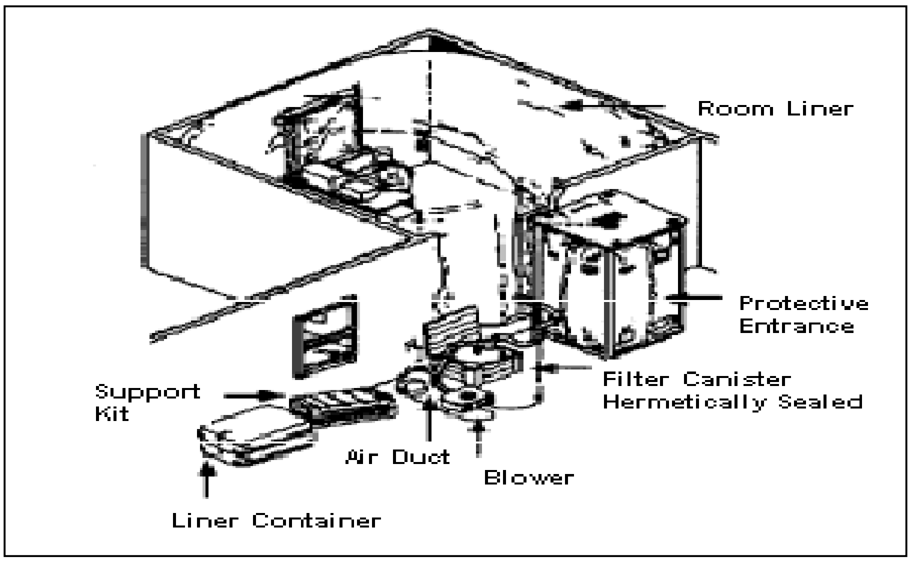


Figure B-5. M20 Simplified Collective Protection Equipment (SCPE)

(2) Class II, Intermediate. This class of shelters is for continuous protection in buildings which have forced ventilation. This class is for protection from terrorist use of CB and/or radiological agents. Its focus is on protecting existing outside air intakes. Air filtration equipment is applied to the outside air intakes and the normal rates of introduction of outside air with little or no overpressure are maintained.

(3) Class III, Passive. This class of shelters is described as unventilated shelters, and may be used for an incident such as a transient release of a toxic industrial chemical.

Limited protection is achieved by closing the building and turning off the HVAC before the cloud arrives.

b. Protective Equipment-Protective Entrances. Protective entrances provide an interface between the contaminated environment and the protected enclosure. Protective entrances include –

(1) Protective Entrance Without Airlock. In a contaminated environment, overpressure systems not having a protective entrance (air lock) must preclude contamination from entering the enclosure. Drills and procedures must be established for this purpose. A system without an air lock consists of a clean interior shelter area only. During a liquid or vapor chemical attack, the system must remain closed, and personnel must not enter or exit. Opening the doors allows contamination inside, and personnel must assume a higher MOPP level until the interior is purged or decontaminated.

(2) Protective Entrance With Airlock. An air lock prevents contamination from entering the enclosure. The air lock is pressurized, and contamination is eliminated through the use of filtered air. Air pressure in the entrance is slightly less than that in the protective enclosure, but slightly more than outside pressure. An airlock is a transition enclosure—a protected entryway in which people wait for a period of 3-5 minutes before entering or exiting the toxic free Area. The main function of the airlock is to prevent direct vapor transport into the TFA. During the airlock purging period, the flow of filtered air through the airlock flushes out airborne contaminants introduced with the opening of the outer door. The airlock also ensures that TFA overpressure is not compromised during entry or exit. Air passing through the air lock purges contaminants that might enter during entry or exit of personnel or equipment. This air comes from the protective enclosure, the filter unit, or both. Different protective entrance configurations create variations of the

overpressure category. The variations are those with a single air lock and those with a two-stage air lock.

(3) Protective Entrance With Single Airlock. Many shelters modified for collective protection use a single-compartment protective entrance. An example is the M12 protective entrance (Figure B-6). Using a dedicated filter unit for the airlock helps maintain TFA integrity. Before entering the air lock from a contaminated area, personnel must remove their MOPP gear except gloves and mask. Minor exposure to chemical agent vapor is possible between overgarment removal and entrance into the air lock. Clothing tends to absorb any chemical agent vapor in the atmosphere during this brief exposure. The amount of agent absorbed depends on agent concentration in the atmosphere, length of exposure, type of agent, type of clothing exposed, and climatic conditions. The air purge in the air lock flushes out the contaminated air. It also reduces the amount of absorbed agent on clothing before the individual enters the protective shelter. After an individual and/or piece of equipment enters the protective shelter, monitoring ensures hazardous levels of agent are not carried inside.

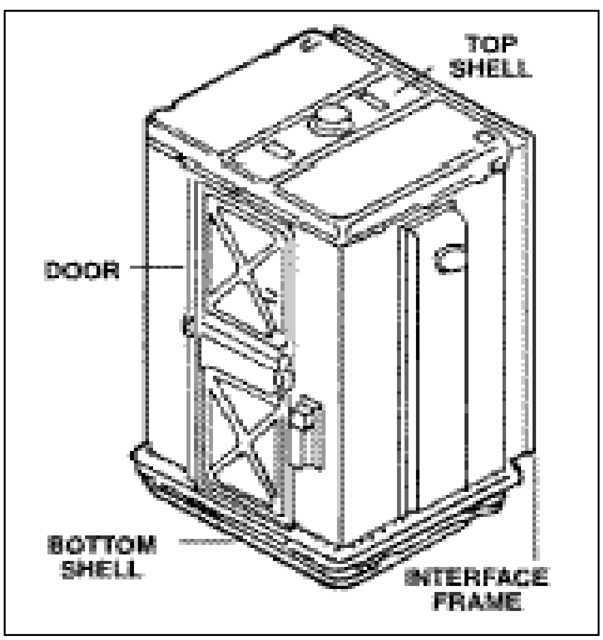


Figure B-6. M12 protective Entrance

(4) Protective Entrance with Two-Stage Airlock. Adding a contamination control area (CCA) to a single air-lock system creates a two-stage air lock (Figure B-7). Entering personnel remove MOPP gear in the CCA. This system affords better control of the liquid and vapor hazards of entry and exit.

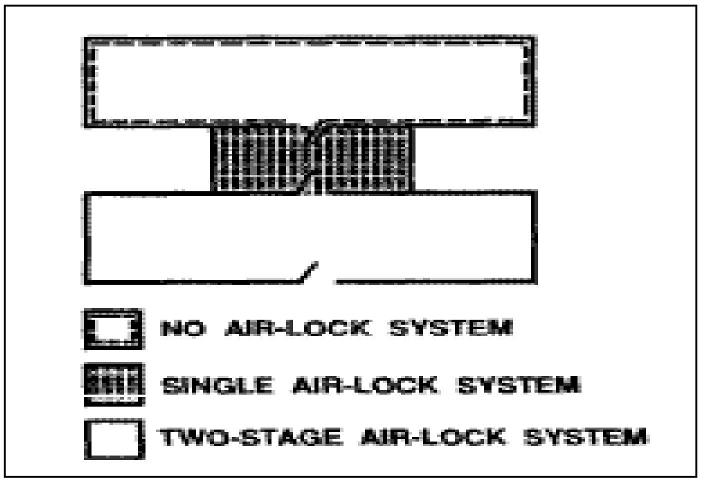


Figure B-7. Collective-Protection Entrance Configurations

(5) Individual Protective Entrances. Integral protective entrances are those that are included in the manufacturing process for the shelter. Integral protective entrances are designed to offer improved accessibility, more convenient storage and transport, and reduced setup time. There are two types of integral protective entrances: internal and external. Integral protective entrances are smaller than the detachable protective entrances and require less airflow during the purge cycle.

- Internal integral protective entrance. Deployed internally, the integral protective entrance can remain in its functional configuration and need not be stowed for transport. Since it is contained within the shelter, it is much less vulnerable on the battlefield.

- External integral protective entrance. The external integral protective entrance is used for shelters that cannot sacrifice the internal space. The self-supporting integral protective entrance must be stowed for transport.

c. Protective Equipment-Establishing Protective Shelters. There is equipment in the US Department of Defense (DOD) inventory, that could be used to establish protective shelters. Examples include the Fan Filter Assembly (FFA) 580 (see Figure B-8); the Air Force A/E32C Air Conditioner (Army C-100); the Field Depolyable Environmental Control Unit (FDECU) (see Figure B-9), the Chemically/Biologically Hardened Air Management Plant (CHAMP), the M96 (MCPE) Filter Unit, and the Filter Unit of the M28 Collective Protection Equipment (CPE) (see Figure B-10).

(1) Modular Collective Protection Equipment. Fan Filter Assembly 580. The Fan Filter Assembly (FFA) 580-filter unit for is a 600 cubic feet per meter (CFM) filter. The FFA 580 employs the modular collective protection equipment filter set which is the most widely used filter set among the USA, USN, and USAF. This unit provides an option for integrating filtration with air conditioning. This unit has the lowest hardware and operating costs among transportable filter units employing standard military filters. Where the building would require more than the capacity of the FFA 580 unit, the M49 filter unit or a large-capacity, commercial filter unit built to military specifications should be considered.

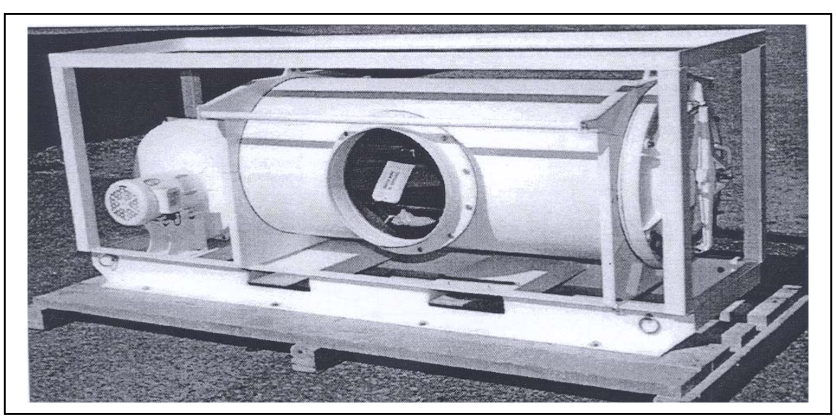


Figure B-8. 1000 CFM Fan Filter Assembly (FFA) 580

(2) Modifying Existing Environmental Control Units. Short of major modifications to the HVAC systems, users could modify an existing environmental control unit by adding a gas particulate filter (see Figures B-9).

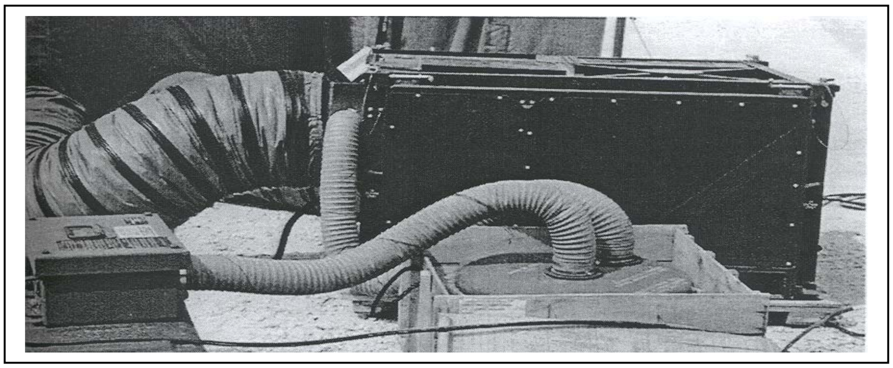


Figure B-9. Field Deployable Environmental Control Unit (FDECU) with NBC Adapter Kit, Filters and Blowers of the M28 CPE

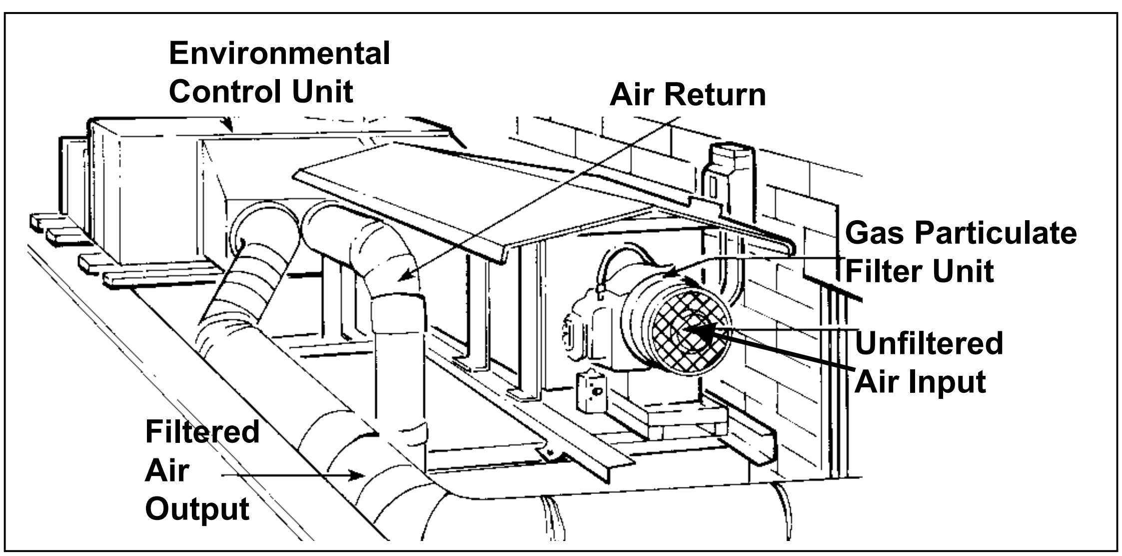


Figure B-10. Modified Environmental Control Unit

Appendix C

HUMAN FACTORS EFFECTS
MISSION ORIENTED PROTECTIVE POSTURE

33. This appendix provides information on the physiological and psychological stress incurred while wearing the Battledress Overgarment (BDO) or the JSLIST. Once an accurate assessment of the NBC threat has been made, the key to selecting an appropriate MOPP level lies in understanding physiological and psychological stresses upon the wearer. Multiple physiological, and psychological, factors can impact unit personnel, and there are countermeasures that can be taken to mitigate the effects. Additionally, this appendix addresses BDO and JSLIST overgarment work/rest and water consumption tables.

44. PHYSIOLOGICAL FACTORS

a. Heat Stress in MOPP.

(1) Background Body temperature must be maintained within narrow limits for optimum physical and mental performance. The body produces more heat during work than rest. Normally, the body cools itself by evaporation of sweat and radiation of heat at the skin's surface. MOPP gear restricts these heat loss mechanisms because of its high insulation and low permeability to water vapor. In addition, physical work tasks require more effort when personnel wear protective clothing because of added weight and restricted movement. Work intensity is also a major contributing factor to heat stress that can be managed by leaders. Military work can be categorized as very light, light, moderate, or heavy. Table C-1 provides examples of work activities that can be used as a guide in estimating the work intensity for a particular mission or task.

(2) Understanding the Heat Stress Process.

(a) Military personnel wearing chemical protective clothing often experience heat stress. To prevent such heat stress from resulting in heat stress related injury, military personnel follow a prescribed cycle of work and rest periods. The work – rest cycles are based on the environment (temperature, humidity, and solar load), workload of the individual, and the clothing ensemble being worn. These work – rest cycles are usually described in terms of minutes of work allowed per hour. The remainder of the hour (after completing the allowed work) is used for rest, to allow heat to dissipate, and to allow the individual to cool down.

(b) Under most conditions, when individuals are wearing heavier garments, the amount of work allowed per hour is less than the amount of work allowed when wearing a lighter garment. However, under some conditions, the work allowed per hour is actually greater when wearing a heavier garment than when wearing a lighter garment.

(c) When an individual is wearing chemical protective clothing, the primary modes of heat exchange between the individual and the surroundings are by conduction, evaporation (of sweat), and (if the sun is out) solar radiation. The nature of chemical protective clothing is such that convective heat transfer (due to the movement of air) is minimized by the garments, and thus, is not a significant factor. Evaporation will always result in a cooling effect for the individual, provided the water vapor can escape from the clothing ensemble. The amount of evaporative cooling will be dependent upon the humidity of the ambient air and upon the rate at which the water vapor can escape.

(d) Solar radiation (if present) will always result in adding heat to the individual. As the sun beats down on the surface of the clothing, the garments will heat up, and eventually that heat will be transferred through the clothing layers to the individual. This heat from the solar radiation will exacerbate the heat stress situation.

(e) Heat transfer by conduction is dependent upon the skin temperature of the individual and the ambient temperature. When the skin temperature is greater than the ambient temperature, then the heat will transfer from the skin to the surrounding air.

When the ambient air temperature is greater than the skin temperature, then the heat will transfer from the surroundings to the skin, heating up the individual.

(f) In most situations, the total heat lost (by evaporation, and conduction if the skin is warmer than the ambient air) is greater than the heat gained (by solar radiation, if present, and by conduction if the air is warmer than the skin). Insulation, of course, reduces the rate at which this heat transfer occurs, but cannot prevent it entirely. The greater the insulation, the lower the rate of heat transfer, and the greater the heat stress induced upon the individual. This is the normal, expected situation in which the heavier garment (i.e. BDO) induces more heat stress than the lighter garment (i.e. JSLIST).

(g) In some cases, especially under conditions of high ambient temperature or under a solar load, the heat gained from the environment is greater than the heat loss. Insulation acts to reduce the rate at which this heat transfer occurs. In this case, the heavier garment acts to protect the individual from the high external heat load better than the lighter garment. Hence, an individual can actually work longer in the heavier garment (i.e. BDO) than in the lighter garment (i.e. JSLIST) under such conditions. Hence, desert nomads wear wool to protect themselves from the high external heat load caused by solar radiation, and high ambient air temperatures.

b. Dehydration.

(1) Impact of Dehydration. Because of higher body temperatures, individuals in MOPP gear sweat considerably more than usual, often more than 1.5 quarts of water every hour during work. Water must be consumed to replace lost fluids or dehydration will follow. Even a slight degree of dehydration impairs the body's ability to regulate its temperature and nullifies the benefits of heat acclimatization and physical fitness, increases the susceptibility to heat injury, and reduces work capacity (including G-tolerance in pilots), appetite, and alertness. Even in individuals who are not heat casualties, the combined

effects of dehydration, restricted heat loss from the body, and increased work effort place a severe strain on the body's functions, and individuals suffer from decrements in mental and physical performance. The difficulty of drinking in MOPP increases the likelihood of dehydration. Thirst is not an adequate indicator of dehydration, and individuals will not sense when they are dehydrated. Individuals will fail to replace body water losses, even when drinking water is readily available.

(2) Mitigation. Individuals should drink as much as possible before donning the mask, and frequent drinking while working is more effective in maintaining hydration than waiting until rest periods to drink. The unit chain of command must take responsibility for enforcing regular and timely fluid replacement in their individuals.

c. Inadequate Nutrition.

(1) Impact of Inadequate Nutrition. In addition to bodily requirements for electrolyte (salt) replacement caused by sustained and excessive sweating, the higher work intensities typical of operations in MOPP lead to an increased demand for calories. Lack of adequate energy supplies can lead to decrements in both physical and mental performance.

(2) Mitigation Measures. The method selected to minimize feeding-related problems depends on availability of safe, uncontaminated areas, as well as other operational constraints. In a contaminated area where there is also a vapor hazard, personnel can be moved into a contamination free or collective-protection facility. Since collective-protection shelters have limited capacity, small groups can be rotated through these facilities. In a contaminated area with no collective protection available, relocate personnel to a safe area for feeding by rotating small portions of the unit or by entire unit replacement. If personnel are in a contaminated area with no detectable vapor hazard or in a clean area where they are under a constant threat of NBC attack, use a rotating method for feeding about 25 percent at any one time and take care to prevent contaminating the food.

d. Miosis – Physiological Impact.

(1) Background. Although MOPP gear may be the most common source of performance problems during NBC operations, some chemical agents, (primarily the nerve agents) can produce performance decrements at exposure levels below that which would cause casualties. The tissues of the eye react to levels of nerve agent vapor that will not effect other bodily systems. Minute amounts of nerve agent in direct contact with the eyes, can affect the eyes, causing constriction of the pupil (miosis), which may or may not be accompanied by spasm of the ciliary muscle causing pain and headache. The pupil is unable to dilate normally in dim light, thus reducing the efficiency of night vision. In the case of liquids, the necessary quantity may arrive as a cloud of extremely fine airborne droplets; or, more insidiously through secondary contamination by pickup on fingers from contaminated equipment or ground. This liquid contamination may then be transferred to the eyes by rubbing, or may slowly evaporate, producing a local vapor concentration. The amount of liquid required is so small that it may not be possible to avoid such transfer by detection of the contamination at its source.

(2) Symptoms and Effects. Eye effects are not always painful and may be very insidious in onset. Miotic subjects may not realize their condition even when carrying out tasks requiring vision in dim light conditions. The duration of exposure required to cause miosis depends on the concentration present. Exposure to a very high concentration of nerve agent vapor can cause miosis in less than the time required for donning the protective mask. Miosis may also occur gradually by exposure over many hours to very low concentrations of vapor produced by the evaporation of liquid nerve agent form contaminated clothing and equipment, or from ground either in the locality or upwind.

(3) Recovery. Miosis will range from minimal to severe depending on the dosage to the eye. Severe miosis and the consequent reduced ability to see In dim light persist for

about 48 hours after onset. After this time, the pupil gradually returns to normal over several days. Full recovery may take up to 20 days. Repeated exposures within this time will be cumulative and subsequently extend the recovery time.

(4) Military Implications of Miosis. Miosis can be expected to negate or reduce the efficiency of performance at night of tasks which depend on unaided night vision. Some examples are aircraft crews, operation of surveillance devices, etc. Identification of miosis sensitive critical tasks and protection of critical specialist personnel should be considered in unit standard operating procedures for operations in a chemical environment.

(5) Procedures to Minimize the Operational Effects of Miosis. Personnel who are particularly dependent on night vision should be examined for miosis in a dim/subdued light. Miotic personnel on critical night missions should be replaced if possible, as some personnel may experience a reduction in peripheral vision. Improvement in miotic personnel peripheral vision may be obtained by training to make more use of their head movements.

(6) Diagnosis of Miosis. The pupils change in diameter dependent on exposure to light and will dilate in the dark. There will be degrees of miosis that are not immediately disabling. Diagnosis of miosis requires clinical conditions, special apparatus and qualified medical personnel.

(7) Medical Countermeasures. At the present time, there is no effective drug to remedy the effects of miosis without causing other visual problems which may be just as debilitating.

(8) Precautions. Certain precautions can be adopted to minimize the incidence of miosis:

- Performing miosis sensitive tasks before there is a risk of encountering miosis producing hazards.

- Masking when in proximity to ground, equipment, or personnel known to have been recently contaminated with liquid nerve agent.
- Decontaminating and/or changing protective clothing as soon as possible for units or individuals known to have been contaminated by liquid nerve agent.
- Contaminated personnel remaining masked as long as possible; if short unmasking periods are permitted, personnel should be widely dispersed in the open air, and those known to have been contaminated should be segregated.
- Avoiding contact of bare hands with contaminated surfaces; protective gloves should be worn when there is suspicion of contamination, and replaced when contaminated. "do not rub eyes".

45. PSYCHOLOGICAL FACTORS

a. Psychological Impact. NBC warfare threat adds to an already stressful situation because it creates unique fears in personnel and isolates them from their environment. MOPP4 reduces the ability to see and hear clearly and makes it more difficult to recognize and communicate with others. This creates or increases feelings of isolation and confusion. The awkwardness of wearing bulky, impermeable garments, gloves, and boots over BDU causes frustration in many personnel and claustrophobia in some. Long periods of reduced mobility and sensory awareness degrade attention and alertness and create or increase feelings of alienation. Chemical filters in the protective mask make breathing more difficult; this too may create feelings of claustrophobia or panic. Combat stress can cause significant numbers of psychiatric casualties; estimates range from 10 percent to 30 percent depending on the duration and intensity of battle. Psychological stress stems not only from the death and destruction that characterize combat, but also from the challenging operational conditions: noise, confusion, and loss of sleep. Challenging operational conditions that create fatigue and cause changes in diet and personal hygiene cause physiological stress as well.

b. Mitigation Measures. The adverse impact of psychological stress during MOPP operations can be minimized by the experience and confidence that realistic training in MOPP gear with protective mask provides. Use of short rest breaks to provide relief from MOPP, combined with adequate sleep (6 or more hours of uninterrupted sleep per 24-hour period is optimum; 4 hours is the minimum for a few days of sustained operations), food, and drink, can sustain performance at an optimal level. During the period of 0100 to 0700, leaders must be aware that the body experiences reduced mental concentration, confusion, nervousness, and lack of clear thinking. Leaders should plan activities to reduce boredom, fatigue, inattention, and discomfort; these are major contributors to ineffective performance.

c. Other Countermeasures. Leaders can minimize the effects of combat stress by attaining and maintaining a high level of unit cohesion and individual identity. Units must train together frequently under demanding conditions. If personnel know that they can overcome adversity together, unit cohesion will be high. Leaders must take a true interest in the welfare of their personnel and build the confidence necessary to withstand the effects of stress. Leaders must keep personnel informed about the tactical situation so that the adverse effects of ambiguity and uncertainty are minimized. Personnel who become ineffective as a result of combat stress should be given a period of rest as close to the front as possible and given reassurance and support by all members of their unit.

46. BATTLE DRESS OVERGARMENT WORK/REST AND WATER CONSUMPTION TABLES

a. The incidence of heat casualties can be reduced if personnel can be allowed to lower their work intensity and/or take more frequent rest breaks. Tables C-2 and C-3 provide information necessary to calculate recommended work/rest cycles for various environmental conditions, clothing levels, and work intensities during daylight and night (or fully shaded) operations, respectively. The work/rest cycles specified in the tables are based on keeping the risk of heat casualties below five percent. Under some operational conditions, work/rest cycles offer no advantage to continuous work (see No Limit [NL] entries in Tables C-2 and C-3). There are other conditions when work/rest cycles offer no advantage. For example, when the environmental and clothing conditions do not permit any cooling during rest (see NA entries in Tables C-2 and C-3); leaders may choose to use the estimated tolerance times such as maximum continuous work times specified in Tables C-4 (daylight) and C-5 (night or shade) to limit the risk of heat casualties to less than five percent.

b. Although strict adherence to work/rest criteria is possible during training exercises, this may not be possible during combat operations. For example, Tables C-4 and C-5 provide guidance on maximum work times. These estimates, representing average expected values within a large population, should be considered approximate guidance and not be used as a substitute for common sense or experience. Individuals will vary in their tolerance. Once the work time limit has been reached, personnel should rest in the shade (using the guidance provided in Table C-6) before returning to work. As Table C-6 clearly shows, reduction of MOPP level during the rest period is the key to maximizing the time personnel can spend performing work.

Table C-1. Work Intensities of Military Tasks

WORK INTENSITY IN MOPP 0-1	ACTIVITY	WORK INTENSITY IN MOPP 2-4
VERY LIGHT	Lying on ground. Standing in fighting position. Sitting in truck.	VERY LIGHT
LIGHT	Cleaning rifle. Walking hard surface/1m/s no load. Walking hard surface/1m/s 20 kg load. Manual of arms. Walking hard surface/1m/s 30 kg load.	LIGHT
MODERATE	Walking loose sand/1m/s no load. Walking hard surface/1.56 m/s no	MODERATE

	load. Calisthenics.	
	Walking hard surface/1.56 m/s 20 kg load. Scouting patrol. Pick and shovel. Crawling full pack.	HEAVY

Table C-1. Work Intensities of Military Tasks (Continued)

WORK INTENSITY IN MOPP 0-1	ACTIVITY	WORK INTENSITY IN MOPP 2-4
HEAVY	Walking hard surface/1.56 m/s 30 kg load. Walking hard surface/2.0 m/s no load. Emplacement digging. Walking hard surface/2.25 m/s no load. Walking loose sand/1.56 m/s no load. Armament crew. Rapid runway repair. Heavy aircraft repair. Diging fighting position. Field assault.	HEAVY

c. In minimizing heat stress, work/rest schedules may be supplemented by microclimate cooling (MCC) systems in which an air or liquid cooled vest worn under the overgarment removes body heat away from skin. MCC systems are available inside certain combat vehicles, but MCC options are not usually available for dismounted personnel. Even when work/rest schedules and MCC are used, an increased risk of performance degradation and heat casualties is inevitable when wearing MOPP in hot weather.

d. Because of higher body temperatures, personnel in MOPP gear sweat considerably more than usual; and personnel are aware that they need to remain hydrated, especially following deployment. Leaders ensure that subordinates maintain proper hydration especially in areas of climatic extreme (i.e., desert environments); and remain alert to any person showing potential heat stress, strokes, or exhaustion symptoms. Water must be consumed to replace lost fluids or dehydration will follow.

e. The difficulty of drinking in MOPP increases the likelihood of dehydration. Thirst is not an adequate indicator of dehydration; and personnel will not sense when they are dehydrated and will fail to replace body water losses, even when drinking water is readily available. Further, water only can be consumed through an individual's mask drinking tube (no additives can be used such as electrolyte replacement). The unit chain of command must take responsibility for enforcing regular and timely fluid replacement in their personnel.

f. Water requirements can be estimated using the guidelines provided in Tables C-7 to C-10. Base the recommended hourly replenishment on current work intensity, temperature, and clothing layers. For example, at a moderate work intensity in MOPP4 (over underwear only) and a daylight wet bulb globe temperature (WBGT) of 80°F an individual should drink approximately 1.5 quarts of water per hour if working continuously or 1.0 quart per hour if working according to the work/rest schedule in Table C-2 (for example, 10 minutes work, 50 minutes rest).

g. Individuals go into MOPP at full hydration and conduct frequent drinking while working. That is more effective than maintaining hydration than waiting until rest periods to drink. The estimates in the tables will also provide logistical personnel with information to use in calculating potential drinking water requirements. Additional water should also be made available for such things as hygiene, cooking, and medical requirements.

Table C-2. Number of Minutes of Work Per Hour in Work/Rest Cycle (Daylight Operations)

MOPP ZERO						MOPP 4 + UNDERWEAR				MOPP 4 + BDU			
WBGT	Ta	VL	L	M	H	VL	L	M	H	VL	L	M	H

<table>
<tr><td>78</td><td>82</td><td rowspan="11">NL</td><td rowspan="8">NL</td><td>NL</td><td>25</td><td rowspan="9">NL</td><td>30</td><td>10</td><td>5</td><td rowspan="9">NL</td><td>25</td><td>10</td><td>5</td></tr>
<tr><td>80</td><td>84</td><td>40</td><td>25</td><td>25</td><td>10</td><td rowspan="11">na</td><td>20</td><td>10</td><td rowspan="11">na</td></tr>
<tr><td>82</td><td>87</td><td>35</td><td>20</td><td>20</td><td>5</td><td>15</td><td rowspan="10">na</td></tr>
<tr><td>84</td><td>89</td><td>30</td><td>20</td><td rowspan="9">na</td><td rowspan="9">na</td><td rowspan="9">na</td></tr>
<tr><td>86</td><td>91</td><td>30</td><td>20</td></tr>
<tr><td>88</td><td>94</td><td>20</td><td>15</td></tr>
<tr><td>90</td><td>96</td><td>20</td><td>10</td></tr>
<tr><td>92</td><td>98</td><td>10</td><td>10</td></tr>
<tr><td>94</td><td>100</td><td>30</td><td>10</td><td>10</td></tr>
<tr><td>96</td><td>103</td><td>10</td><td rowspan="3">na</td><td rowspan="3">na</td><td rowspan="3">na</td><td rowspan="3">na</td></tr>
<tr><td>98</td><td>105</td><td rowspan="2">na</td></tr>
<tr><td>100</td><td>107</td><td>na</td></tr>
</table>

KEY TO TABLE

WBGT – Wet bulb globe temperature [° F].
Ta Ambient temperature (Dry bulb - ° F).
VL – Very light work intensity.
L – Light work intensity.
M – Moderate work intensity.
H – Heavy work intensity.
BDU – Battle dress uniform.
NL – No limit (continous work possible).
na - Work/rest cycle not feasible.
(See maximum work time in table C-4)

INSTRUCTIONS AND NOTES:

This table provides for four levels of work intensity (see table C-1), the number of minutes of work per hour in work/rest schedules tailored to the conditions specified. The remainder of each hour should be spent in rest. This table was prepared using the prediction capability of the USARIEM Heat Strain Model. Assumptions used in generating this table include: 1) troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) clear skies; 5) heat casualties < 5%. This guide should not be used as a substitute for common sense or individual experience. Individual requirements may vary greatly. The appearance of heat casualties is evidence that the selected work/rest schedule is inappropriate for the conditions.

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Table C-3. Number of Minutes of Work Per Hour in Work/Rest Cycle (Night Operations)

MOPP ZERO						MOPP 4 + UNDERWEAR				MOPP 4 + BDU			
WBGT	Ta	VL	L	M	H	VL	L	M	H	VL	L	M	H
60	68				40			30	20			25	15
66	75				40			25	15			25	15

72	82	NL	NL	NL	35	NL	NL	20	15	NL	NL	20	10
78	88				30			15	10			15	10
80	91				25			15	5			15	5
82	93				25		30	10	5		25	10	5
84	95			40	25		25	10	na		20	5	na
86	97			35	20		15	5			10	na	
88	100			30	20		na	na			na		
90	102			25	15								
92	104			20	15								
94	106			15	10								

KEY TO TABLE

WBGT – Wet bulb globe.
Temperature [° F].
Ta Ambient temperature (Dry bulb - ° F).
VL – Very light work intensity.
L – Light work intensity.
M – Moderate work intensity.
H – Heavy work intensity.
BDU – Battle dress uniform.
NL – No limit (continuous work possible).
na – Work/rest cycle not feasible (see maximum work time in Table C-5).

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INSTRUCTIONS AND NOTES:

This table provides for four levels of work intensity (see table C-1), the number of minutes of work per hour in work/rest schedules tailored to the conditions specified. This table was prepared using the prediction capability of the USARIEM Heat Strain Model. Assumptions used in generating this table include: 1) troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) no solar load; 5) heat casualties < 5%. This guide should not be used as a substitute for common sense or experience; individual requirements may vary greatly. The appearance of heat casualties is evidence that the selected work/rest schedule and/or water consumption guidance is inappropriate for the conditions.

Table C-4. Maximum Work Times (Minutes) (Daylight Operations)

MOPP ZERO						**MOPP 4 + UNDERWEAR**				**MOPP 4 + BDU**			
WBGT	**Ta**	**VL**	**L**	**M**	**H**	**VL**	**L**	**M**	**H**	**VL**	**L**	**M**	**H**
78	**82**			**NL**	**65**		177	50	33		155	49	32
80	**84**			**157**	**61**		142	49	32		131	48	32

82	**87**	**NL**	**NL**	**114**	**56**	NL	115	47	31		110	46	30
84	**89**			**99**	**53**		104	45	30		100	45	30
86	**91**			**87**	**50**		95	44	29		93	44	29
88	**94**			**74**	**45**		85	42	28		83	42	27
90	**96**			**67**	**43**		79	41	27		78	41	27
92	**98**			**60**	**40**		75	40	26		74	40	26
94	**100**		**193**	**55**	**37**		70	39	25		70	39	25
96	**103**		**101**	**48**	**33**	203	65	37	23	194	65	37	23
98	**105**		**82**	**44**	**31**	141	62	36	22	140	62	36	22
100	**107**	**261**	**70**	**41**	**28**	118	59	35	21	118	59	35	21

KEY TO TABLE

WBGT – Wet bulb globe.
Temperature [° F].
Ta Ambient temperature (Dry bulb - ° F).
VL – Very light work intensity.
L – Light work intensity.
M – Moderate work intensity.
H – Heavy work intensity.
BDU – Battle dress uniform.
NL - No limit (continuous work possible).

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INSTRUCTIONS AND NOTES:

This table provides for four levels of work intensity (see table C-1), the maximum number of minutes work can be sustained in a single work period without exceeding a greater than 5% risk of heat casualties. This table was prepared using the prediction capability of the USARIEM Heat Strain Model. Assumptions used in generating this table include: 1) troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) clear skies. This guide should not be used as a substitute for common sense or individual experience. Individual requirements may vary greatly. The appearance of heat casualties is evidence that the safe limits of work time have been reached.

Table C-5. Maximum Work Times (minutes) (Night Operations)

MOPP ZERO						MOPP 4 + UNDERWEAR				MOPP 4 + BDU			
WBGT	**Ta**	**VL**	**L**	**M**	**H**	**VL**	**L**	**M**	**H**	**VL**	**L**	**M**	**H**
60	68				188			76	42			73	41
66	75				119			66	39			64	38

72	82	NL	NL	NL	90	NL	NL	58	36	NL	NL	57	36
78	88				72			53	34			52	33
80	91				64			50	32			50	32
82	93				60		206	49	32		168	48	31
84	95			139	55		144	47	31		133	47	30
86	97			107	51		121	46	30		115	45	29
88	100			82	46		100	44	28		97	43	28
90	102			71	42		91	42	27		89	42	27
92	104			63	39		83	41	26		82	41	26
94	106			56	36		77	40	25		76	40	25

KEY TO TABLE

WBGT – Wet bulb globe.
Temperature [° F].
Ta Ambient temperature (Dry bulb - ° F).
VL – Very light work intensity.
L – Light work intensity.
M – Moderate work intensity.
H – Heavy work intensity.
BDU – Battle dress uniform.
NL - No limit (continuous work possible).

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INSTRUCTIONS AND NOTES:

This table provides for four levels of work intensity (see table C-1), the maximum number of minutes work can be sustained in a single work period without exceeding a greater than 5% risk of heat casualties. This table was prepared using the prediction capability of the USARIEM Heat Strain Model. Assumptions used in generating this table include: 1) troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) no solar load. This guide should not be used as a substitute for common sense or individual experience. Individual requirements may vary greatly. The appearance of heat casualties is evidence that the safe limits of work time have been reached.

Table C-6. Recovery Time Estimates After Maximum Work (Hours of Rest in the Shade)

WBGT	Ta	MOPP ZERO	MOPP 4
60	68	0.25	1.0
66	75	0.25	1.0

KEY TO TABLE

WBGT - Wet bulb globe Temperature [° F]. As measured in shade (if only full sun WBGT is available. Subtract 5°F WBGT before using this table).

72	82	0.5	1.5
74	84	0.5	1.5
76	86	0.5	2.0
78	88	0.5	2.0
80	91	0.5	3.0
82	93	0.5	4.0
84	95	0.5	6.0
86	97	1.0	15.0
88	100	1.0	NCP
90	102	1.0	NCP
92	104	1.5	NCP
94	106	2.0	NCP
96	109	8.0	NCP
98	111	NCP	NCP
100	113	NCP	NCP

Ta – Ambient Temperature (dry bulb - °F).
MOPP Zero – Battle Dress Uniform only.
MOPP 4 – Battle Dress Overgarment and Mask (closed).
NCP – No cooling possible under these conditions – seek cooler location and/or remove BDO.

NOTES AND INSTRUCTIONS

This table provides the number of hours rest in the shade that should be required after working the maximum work times specified in Table C-4 or C-5. This table was prepared using the cooling capacity equations of the USARIEM Heat Strain Model. Assumptions used in generating this table include: 1) troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) no solar load; 5) recovery of normal body temperature. This guidance is not a substitute for common sense or individual experience; individual requirements may vary greatly.

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Table C-7. Water Requirements for Work/Rest Cycles (qt/hr) (daylight Operations)

MOPP ZERO						MOPP 4 + UNDERWEAR				MOPP 4 + BDU			
WBGT	**Ta**	**VL**	**L**	**M**	**H**	**VL**	**L**	**M**	**H**	**VL**	**L**	**M**	**H**
78	82	0.5	1,0	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

<table>
<tr><td>80</td><td>84</td><td>0.5</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td rowspan="11">na</td><td>1.0</td><td>1.0</td><td>1.0</td><td rowspan="11">na</td></tr>
<tr><td>82</td><td>87</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td rowspan="10">na</td></tr>
<tr><td>84</td><td>89</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td rowspan="9">na</td><td rowspan="9">na</td><td>1.0</td><td rowspan="9">na</td></tr>
<tr><td>86</td><td>91</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td></tr>
<tr><td>88</td><td>94</td><td>1.0</td><td>1.5</td><td>1.0</td><td>1.0</td><td>1.5</td><td>1.5</td></tr>
<tr><td>90</td><td>96</td><td>1.0</td><td>1.5</td><td>1.0</td><td>1.0</td><td>1.5</td><td>1.5</td></tr>
<tr><td>92</td><td>98</td><td>1.0</td><td>1.5</td><td>1.0</td><td>1.0</td><td>1.5</td><td>1.5</td></tr>
<tr><td>94</td><td>100</td><td>1.0</td><td>1.5</td><td>1.5</td><td>1.0</td><td>1.5</td><td>1.5</td></tr>
<tr><td>96</td><td>103</td><td>1.0</td><td>1.5</td><td rowspan="3">na</td><td rowspan="3">na</td><td rowspan="3">na</td><td rowspan="3">na</td></tr>
<tr><td>98</td><td>105</td><td>1.5</td><td rowspan="2">na</td></tr>
<tr><td>100</td><td>107</td><td>na</td></tr>
</table>

KEY TO TABLE

WBGT – Wet bulb globe.
Temperature [° F].
Ta Ambient temperature (Dry bulb - ° F).
VL – Very light work intensity.
L – Light work intensity.
M – Moderate work intensity.
H – Heavy work intensity.
BDU – Battle dress uniform.
na – Work/Rest Cycle not feasible.

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INSTRUCTIONS AND NOTES:

Water requirements listed are for both the work/rest schedules specified in Table G-2 for support of sustained work and work times unrestricted by thermal stress, (same as tables C-4 and C-5). Work intensities may be estimated using Table C-1. Drinking should be divided over course of each hour to replace water as it is lost to sweat. This table was prepared using the prediction capability of the USARIEM Heat Strain Model. Asumptions used in generating this table include: 1) troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) clear skies; 5) heat casualties < 5%. This guidance is not a substitute for common sense or individual experience; appearance of heat casualties is evidence that the safe worklimits (< 5 % casualties) have been exceeded.

Table C-8. Water Requirements For Maximum Work Times (qt/hr) (daylight Operations)

MOPP ZERO						MOPP 4 + UNDERWEAR				MOPP 4 + BDU			
WBGT	**Ta**	**VL**	**L**	**M**	**H**	**VL**	**L**	**M**	**H**	**VL**	**L**	**M**	**H**
78	**82**	**.5**	**1.0**	**1.5**	**1.5**	1.0	1.5	**1.5**	**1.5**	**1.0**	1.5	1.5	**1.5**

80	84	.5	1.0	1.5	1.5	1.0	1.5	1.5	1.5	1.0	1.5	1.5	1.5
82	87	1.0	1.0	1.5	1.5	1.0	1.5	1.5	1.5	1.0	1.5	1.5	1.5
84	89	1.0	1.0	1.5	1.5	1.0	1.5	1.5	1.5	1.0	1.5	1.5	1.5
86	91	1.0	1.0	1.5	1.5	1.0	1.5	1.5	1.5	1.0	1.5	1.5	1.5
88	94	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
90	96	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
92	98	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
94	100	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
96	103	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
98	105	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
100	107	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

KEY TO TABLE

WBGT – Wet bulb globe.
Temperature [° F].
Ta Ambient temperature (Dry bulb - ° F).
VL – Very light work intensity.
L – Light work intensity.
M – Modeerate work intensity.
H – Heavy work intensity.
BDU – Battle dress uniform.

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INSTRUCTIONS AND NOTES:

Amounts listed are required to support maximum work times in Table C-4; estimates work intensities using Table C-1. Drinking should be divided over courses of each hour. If water requirements is 2.0, sweat loss is greater than maximum water absorption during an hour, and personnel will become increasingly dehydrated regardless of amount drunk; leaders should plan for an extended rest and rehydration period at work completion. This table was prepared using the prediction capability of the USARIEM Heat Strain Model. Assumptions used in generating this table include: 1) troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) clear skies; 5)) heat casualties < 5%. This guidance is not a substitute for common sense or individual experience; appearance of heat casualties is evidence that the safe work limits (casualties) have been exceeded.

Table C-9. Water Requirements for Work/Rest Cycles (qt/hr) (Night Operations)

MOPP ZERO						MOPP 4 + UNDERWEAR				MOPP 4 + BDU			
WBGT	**Ta**	**VL**	**L**	**M**	**H**	**VL**	**L**	**M**	**H**	**VL**	**L**	**M**	**H**
60	68	0.25	0.25	0.5	1.0	0.25	1.0	1.0	1.0	0.25	1.0	1.0	1.0

<table>
<tr><td>66</td><td>75</td><td>0.25</td><td>0.25</td><td>1.0</td><td>1.0</td><td>0.5</td><td>1.0</td><td>1.0</td><td>1.0</td><td>0.5</td><td>1.0</td><td>1.0</td><td>1.0</td></tr>
<tr><td>72</td><td>82</td><td>0.25</td><td>0.5</td><td>1.0</td><td>1.0</td><td>0.5</td><td>1.0</td><td>1.0</td><td>1.0</td><td>0.5</td><td>1.0</td><td>1.0</td><td>1.0</td></tr>
<tr><td>78</td><td>88</td><td>0.25</td><td>0.5</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.5</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.5</td><td>1.0</td><td>1.0</td></tr>
<tr><td>80</td><td>91</td><td>0.5</td><td>1.0</td><td>1.5</td><td>1.0</td><td>1.0</td><td>1.5</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.5</td><td>1.0</td><td>1.0</td></tr>
<tr><td>82</td><td>93</td><td>0.5</td><td>1.0</td><td>1.5</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td></tr>
<tr><td>84</td><td>95</td><td>0.5</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td rowspan="7">na</td><td>1.0</td><td>1.0</td><td>1.0</td><td rowspan="7">na</td></tr>
<tr><td>86</td><td>97</td><td>0.5</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td rowspan="6">na</td></tr>
<tr><td>88</td><td>100</td><td>0.5</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td rowspan="5">na</td><td rowspan="5">na</td><td>1.0</td><td rowspan="5">na</td></tr>
<tr><td>90</td><td>102</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td><td>1.0</td></tr>
<tr><td>92</td><td>104</td><td>1.0</td><td>1.5</td><td>1.0</td><td>1.0</td><td>1.5</td><td>1.5</td></tr>
<tr><td>94</td><td>106</td><td>1.0</td><td>1.5</td><td>1.0</td><td>1.0</td><td>1.5</td><td>1.5</td></tr>
</table>

KEY TO TABLE

WBGT – Wet bulb globe.
Temperature [° F].
Ta Ambient temperature (Dry bulb - ° F).
VL – Very light work intensity.
L – Light work intensity.
M – Moderate work intensity.
H – Heavy work intensity.
BDU – Battle dress uniform.

USARIEM 1/11/91.

INSTRUCTIONS AND NOTES:

Amounts listed are required to support maximum work times in Table C-3; estimate work intensities using Table C-1. Drinking should be divided over courses of each hour. If water requirements is 2.0, sweat loss is greater than maximum water absorption during an hour, and personnel will become increasingly dehydrated regardless of amount drunk; leaders should plan for an extended rest and rehydration period at work completion. This table was prepared using the prediction capability of the USARIEM Heat Strain Model. Asumptions used in generating this table include: 1) troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) clear skies. This guidance is not a substitute for common sense or individual experience; appearance of heat casualties is evidence that the safe (< 5 % casualties) worklimits have been reached.

Table C-10. Water Requirements For Maximum Work Times (qt/hr) (Night Operations)

MOPP ZERO						MOPP 4 + UNDERWEAR				MOPP 4 + BDU			
WBGT	**Ta**	**VL**	**L**	**M**	**H**	**VL**	**L**	**M**	**H**	**VL**	**L**	**M**	**H**
60	**68**	**0.25**	**0.25**	**0.5**	**1.0**	0.25	1.0	1.5	**1.5**	0.25	1.0	1.5	**1.5**

66	75	0.25	0.25	1.0	1.5	0.5	1.0	1.5	1.5	0.5	1.0	1.5	1.5
72	82	0.25	0.5	1.0	1.5	0.5	1.0	1.5	1.5	0.5	1.0	1.5	1.5
78	88	0.25	0.5	1.0	1.5	1.0	1.5	1.5	1.5	1.0	1.5	1.5	1.5
80	91	0.5	1.0	1.5	1.5	1.0	1.5	1.5	1.5	1.0	1.5	1.5	1.5
82	93	0.5	1.0	1.5	1.5	1.0	1.5	1.5	1.5	1.0	1.5	1.5	1.5
84	95	0.5	1.0	1.5	1.5	1.0	1.5	1.5	1.5	1.0	1.5	1.5	1.5
86	97	0.5	1.0	1.5	1.5	1.0	1.5	1.5	1.5	1.0	1.5	1.5	1.5
88	100	0.5	1.0	1.5	1.5	1.0	1.5	1.5	1.5	1.0	1.5	1.5	1.5
90	102	1.0	1.0	1.5	1.5	1.0	1.5	1.5	1.5	1.0	1.5	1.5	1.5
92	104	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
94	106	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

KEY TO TABLE

WBGT – Wet bulb globe.
Temperature [° F].
Ta Ambient temperature (Dry bulb - ° F).
VL – Very light work intensity.
L – Light work intensity.
M – Modeerate work intensity.
H – Heavy work intensity.
BDU – Battle dress uniform.
NL - No limit (continuous work possible).

USARIEM 1/11/91.

INSTRUCTIONS AND NOTES:

Amounts listed are required to support maximum work times in Table C-5; drinking should be divided over courses of each hour. If water requirements is 2.0, sweat loss is greater than maximum water absorption during an hour, and personnel will become increasingly dehydrated regardless of amount drunk; leaders should plan for an extended rest and rehydration period at work completion. This table was prepared using the prediction capability of the USARIEM Heat Strain Model. Assumptions used in generating this table include: 1) troops fully hydrated, rested, and acclimatized; 2) 50% relative humidity; 3) windspeed = 2 m/s; 4) no solar load; 5)) heat casualties < 5%. This guidance is not a substitute for common sense or individual experience; appearance of heat casualties is evidence that the safe work limits (casualties) have been exceeded.

47. JSLIST WORK/REST AND WATER CONSUMPTION TABLES

34. Tables C-11 to C-18 provide estimates on JSLIST work/rest cycles for very light, moderate, and heavy work rates. The tables provide work rest estimates for wearing of the JSLIST over the BDU and wear of the JSLIST with no duty uniform worn underneath. The individual tables provide information on the following:
    a. Work/rest cycles and water requirements (while wearing JSLIST over the battle

dress uniform and wearing JSLIST without a duty uniform).

b. Maximum work times (i.e., one time maximum work) and water requirements.

Table C-11. JSLIST Work/Rest Cycle (Very Light Work) With Battle Dress Uniform (BDU)

VERY LIGHT WORK										
							Recovery Time After Max Work			
			Work/Rest Cycle		One Time Max Work		Resting		Resting In Shade	
Ta	Rh	Wgbt	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]
80	50	76.0	NL	0.6	NL	0.7	74	0.5	47	0.2
90	50	84.5	NL	0.9	NL	0.9	239	0.7	82	0.4
95		88.8	NL	1.0	NL	1.1		0.9		0.5
95	75	94.8	NL	1.3	NL	1.4	NCP	1.1	NCP	0.7
100	50	93.1	NL	1.2	NL	1.3	NCP	1.1	570	0.7
105	50	97.4	NFW	NA	157	1.6	NCP	1.3	NCP	0.9
120	20	97.9	NFW	NA	147	1.6	NCP	1.4	NCP	1.1

Wind Speed = 5mph = 2.25m/s.
Clear Sky.

M = 150 [very light]; 250 [light]; 425 [moderate]; 600 [heavy].
Casualty level = light.
Acclimination level = full.

Garment Configuration: Hot weather Battle Dress Unifirm (BDU), JSLIST Overgarment, M40A1 Mask, Combat Boots, Green Vinyl Overshoes, and Butyl Rubber Gloves (Worn in MOPP 4)

NA = Not applicable.

NL = No limit.

NFW = No further work.

NCP = No cooling power.

Shaded rows are HHA required conditions.

Table C-12. JSLIST Work/Rest Cycle (Very Light Work) No Duty Uniform

VERY LIGHT WORK										
							Recovery Time After Max Work			
			Work/Rest Cycle		One Time Max Work		Resting		Resting In Shade	
Ta	Rh	Wgbt	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]
80	50	76.0	NL	0.6	NL	0.6	55	0.4	36	0.2
90	50	84.5	NL	0.8	NL	0.9	139	0.7	59	0.3
95	50	88.8	NL	1.0		1.1	832		93	0.5
95	75	94.8	NL	1.3	NL	1.1	NCP		NCP	0.6
100	50	93.1	NL	1.2	NL	1.3	NCP	1.1	228	0.7
105	50	97.4	NFW	NA	144	1.6	NCP	1.3	NCP	0.9
120	20	97.9	NFW	NA	133	1.6	NCP	1.4	NCP	1.1

Wind Speed = 5mph = 2.25m/s.
Clear Sky.

M = 150 [very light]; 250 [light]; 425 [moderate]; 600 [heavy].
Casualty level = light.
Acclimination level = full.
Garment Configuration: JSLIST Overgarment (No Duty Uniform), JSLIST Overgarment, M40A1 Mask, Combat Boots, Green Vinyl Overshoes, and Butyl Rubber Gloves (Worn in MOPP 4).

NA = Not applicable.

NL = No limit.

NFW = No further work.

NCP = No cooling power.

HHA = Health hazard assessment

Shaded rows are HHA required conditions.

Table C-13. JSLIST Work/Rest Cycle (Light Work) With Battle Dress Uniform (BDU)

LIGHT WORK										
							Recovery Time After Max Work			
			Work/Rest Cycle		One Time Max Work		Resting		Resting In Shade	
Ta	Rh	Wgbt	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]
80	50	76.0	NL	1.0	NL	1.1	74	0.5	47	0.2
90	50	84.5	24	1.0	142	1.4	239	0.7	82	0.4
95		88.8	NFW	NA	97	1.5	NCP	0.9	140	0.5
95	75	94.8	NFW	NA	70	1.5	NCP	1.1	NCP	0.7
100	50	93.1	NFW	NA	76	1.5	NCP	1.1	NCP	0.7
105	50	97.4	NFW	NA	64	1.5	NCP	1.3	NCP	0.9
120	20	97.9	NFW	NA	64	1.5	NCP	1.4	NCP	1.1

Wind Speed = 5mph = 2.25m/s.

Clear Sky.

M = 150 [very light]; 250 [light]; 425 [moderate]; 600 [heavy].

Casualty level = light.

Acclimination level = full.

Garment Configuration: Hot weather Battle Dress Unifirm (BDU), JSLIST Overgarment, M40A1 Mask, Combat Boots, Green Vinyl Overshoes, and Butyl Rubber Gloves (Worn in MOPP 4)

NA = Not applicable.

NL = No limit.

NFW = No further work.

NCP = No cooling power.

HHA = Health hazard assessment

Shaded rows are HHA required conditions.

Table C-14. JSLIST Work/Rest Cycle (Light Work) No Duty Uniform

LIGHT WORK										
							Recovery Time After Max Work			
			Work/Rest Cycle		One Time Max Work		Resting		Resting In Shade	
Ta	Rh	Wgbt	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]
80	50	76.0	NL	0.9	NL	1.0	55	0.4	36	0.2
90	50	84.5	31	1.0	267	1.3	139	0.7	59	0.3
95	50	88.8	14	1.0	105	1.5	832	0.9	93	0.5
95	75	94.8	NFW	NA	71	1.5	NCP	1.1	NCP	0.6
100	50	93.1	NFW	NA	78	1.5	NCP	1.1	228	0.7
105	50	97.4	NFW	NA	63	1.5	NCP	1.3	NCP	0.9
120	20	97.9	NFW	NA	63	1.5	NCP	1.4	NCP	1.1

Wind Speed = 5mph = 2.25m/s.

Clear Sky.

M = 150 [very light]; 250 [light]; 425 [moderate]; 600 [heavy].

Casualty level = light.

Acclimination level = full.

M40A1 Mask, Combat Boots, Green Vinyl Overshoes, and Butyl Rubber Gloves (Worn in MOPP 4)

NA = Not applicable.

NL = No limit.

NFW = No further work.

NCP = No cooling power.

HHA = Health hazard assessment

Shaded rows are HHA required conditions.

Table C-15. JSLIST Work/Rest Cycle (Moderate Work) With Battle Dress Uniform (BDU)

MODERATE WORK										
							Recovery Time After Max Work			
			Work/Rest Cycle		One Time Max Work		Resting		Resting In Shade	
Ta	Rh	Wgbt	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]
80	50	76.0	19	0.9	60	1.5	74	0.5	47	0.2
90	50	84.5	10	0.9	49	1.5	239	0.7	82	0.4
95	50	88.8	NFW	NA	45	1.5	NCP	0.9	140	0.5
95	75	94.8	NFW	NA	39		NCP	1.1	NCP	0.7
100	50	93.1	NFW	NA	41	1.5	NCP	1.1	NCP	0.7
105	50	97.4	NFW	NA	37	1.5	NCP	1.3	NCP	0.9
120	20	97.9	NFW		38		NCP	1.4	NCP	1.1

Wind Speed = 5mph = 2.25m/s.

M = 150 [very light]; 250 [light]; 425 [moderate]; 600 [heavy].

Casualty level = light.

Acclimination level = full.

Garment Configuration: Hot Weather Battle Dress Uniform (BDU), JSLIST Overgarment, M40A1 Mask, Combat Boots, Green Vinyl Overshoes, and Butyl Rubber Gloves (Worn in MOPP 4).

NA = Not applicable.

NCP = No cooling power.

HHA = Health hazard assessment

Table C-16. JSLIST Work/Rest Cycle (Moderate Work) No Duty Uniform

MODERATE WORK										
							Recovery Time After Max Work			
			Work/Rest Cycle		One Time Max Work		Resting		Resting In Shade	
Ta	Rh	Wgbt	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]
80	50	76.0	23	0.9	67	1.5	55	0.4	36	0.2
90	50	84.5	13	1.0	52	1.5	139	0.7	59	0.3
95	50	88.8	NFW	NA	46		832	0.9	93	0.5
95	75	94.8	NFW		39	1.5	NCP	1.1	NCP	0.6
100	50	93.1	NFW	NA	42	1.5	NCP	1.1	228	0.7
105	50	97.4	NFW	NA	37	1.5	NCP	1.3	NCP	0.9
120	20	97.9	NFW	NA	37	1.5	NCP	1.4	NCP	1.1

Wind Speed = 5mph = 2.25m/s.

Clear Sky.

M = 150 [very light]; 250 [light]; 425 [moderate]; 600 [heavy].

Casualty level = light.

Acclimination level = full.

Garment JSLIST Overgarment (no duty uniform), M40A1 Mask, Combat Boots, Green Vinyl Overshoes, and Butyl Rubber Gloves (Worn in MOPP 4).

NA = Not applicable.

NL = No limit.

NFW = No further work.

Shaded rows are HHA required conditions.

Table C-17. JSLIST Work/Rest Cycle (Heavy Work) With Battle Dress Uniform (BDU)

HEAVY WORK										
							Recovery Time After Max Work			
			Work/Rest Cycle		One Time Max Work		Resting		Resting In Shade	
Ta	Rh	Wgbt	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]
80	50	76.0	12	0.8	38	1.5	74	0.5	47	0.2
90	50	84.5	5	0.8	33	1.5	239	0.7	82	0.4
95		88.8	NFW		30	1.5	NCP		140	0.5
	75	94.8	NFW	NA	25	1.5	NCP	1.1	NCP	0.7
100	50	93.1	NFW	NA	27	1.5	NCP	1.1	570	0.7
105	50	97.4	NFW	NA	23	1.5	NCP	1.3	NCP	0.9
120	20	97.9	NFW	NA	24	1.5	NCP		NCP	1.1

Wind Speed = 5mph = 2.25m/s.

Clear Sky.

M = 150 [very light]; 250 [light]; 425 [moderate]; 600 [heavy].

Acclimination level = full.

Garment Configuration: Hot Weather Battle Dress Uniform (BDU), JSLIST Overgarment, M40A1 Mask, Combat Boots, Green Vinyl Overshoes, and Butyl Rubber Gloves (Worn in MOPP 4).

NA = Not applicable.

NL = No limit.

NFW = No further work.

NCP = No cooling power.

HHA = Health hazard assessment

Table C-18. JSLIST Work/Rest Cycle (Heavy Work) No Duty Uniform

HEAVY WORK										
							Recovery Time After Max Work			
			Work/Rest Cycle		One Time Max Work		Resting		Resting In Shade	
Ta	Rh	Wgbt	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]	Time [min]	Water Req [qts]
80	50	76.0	15	0.8	41	1.5	55	0.4	36	0.2
90	50	84.5	7	0.9	34	1.5	139	0.7	59	0.3
95	50		NFW	NA	31		832	0.9	93	0.5
95	75	94.8	NFW	NA		1.5	NCP	1.1		0.6
100	50	93.1	NFW	NA	27	1.5	NCP	1.1	228	0.7
105	50	97.4	NFW	NA	23	1.5	NCP	1.3	NCP	0.9
120	20	97.9		NA	24	1.5		1.4	NCP	
Wind Speed = 5mph = 2.25m/s.										
Clear Sky.								NL = No limit.		
M = 150 [very light]; 250 [light]; 425 [moderate]; 600 [heavy].								NFW = No further work.		
Casualty level = light.								NCP = No cooling power.		
Acclimination level = full.								HHA = Health hazard assessment		
Garment JSLIST Overgarment (no duty uniform), M40A1 Mask, Combat Boots, Green Vinyl Overshoes, and Butyl Rubber Gloves (Worn in MOPP 4).								Shaded rows are HHA required conditions.		

Appendix D

RADIOLOGICAL PROTECTION (Operational Exposure Guidance, Low Level Radiation Exposure, Depleted Uranium)

35. Radiological protection involves using Operational Exposure Guidance (OEG) as a critical factor in protecting the force. Radiation exposure can create casualties and must be monitored as another critical element of the commanders force health protection program. Commanders must ensure that accurate records are kept for their personnel and that previous exposure is considered when selecting individuals and units for missions. Total dose exposure is critical from two different standpoints. Based on radiation exposure, commanders assess unit capabilities and the ability of that asset to perform its mission. Additionally, the individual cumulative dose of each individual service member represents on a composite basis the unit's radiation exposure status (OES) category. Additionally, paragraphs 2 and 3 of this appendix addresses low level radiation exposure and depleted uranium considerations.

48. OPERATIONAL EXPOSURE GUIDANCE REVIEW

a. Introduction.

(1) Operational exposure guidance gives the commander a flexible system of radiation exposure control. OEG procedures aid in the successful employment of a unit while keeping the exposure of personnel to a minimum. Radiation exposure must be controlled to the maximum extent possible consistent with the mission. If exposure control is ignored, unwarrented risks to units and personnel will occur. Establishing and using OEG helps the commander keep radiation exposures to a minimum and still accomplish the mission. OEG is the key for reducing casualties in a radiological environment.

(2) All nuclear radiation, even in small doses, has some harmful effect on the body. It should be avoided whenever possible.

(3) Establishing OEG must be based on a unit's prior exposure because of the cumulative effect, regarding radiation exposure. The commander establishes an OEG for each tactical operation; and maintaining accurate historical OEG records is crucial in tracking previous exposure levels.

(4) An OEG must be established for each unit and each operation. It must be based upon the radiation exposure status of the unit at that time and on the current and projected operational situation.

(5) Effective use of radiation exposure records permits rapid determination of a unit's potential to operate in a radiologically contaminated area. Dose criteria has been established in four categories. Radiation Exposure Status-0 (RES-0), Radiation Exposure Status-1 (RES-1), Radiation Exposure Status-2 (RES-2), and Radiation Exposure Status-3 (RES-3) (See Table D-1). Dose criteria is shown in Table Figure D-1 for each category. This information is based on the best available estimates on predicting the effects of radiation exposure based upon the radiation exposure status of the unit at that time and on the operational situation. The commander can decide which unit to select for a given mission based on the OEG. Each level of command can use the OEG system to select the best unit to conduct a mission. The commander can select which unit to use for a given mission based on the OEG. Each level of command uses the OEG system to select the best unit to conduct a mission. The commander is assured that personnel will receive the least exposure possible. Commanders include OEG guidance in operation orders; and units use OEG and RES guidance to accomplish the mission while minimizing radiation exposure. Based on the OEG, a unit can determine the turn-back dose (Dtb) and turn-back dose rate (Rtb) for a military operation (such as a radiological survey):

Table D-1. Operational Radiation Exposure Status

RADIATION EXPOSURE STATES AND RISK CRITERIA		
Radiation Exposure State	Total Past Cumulative Dose in Centigay (cGy)	Exposure Criteria for a Single Operations Which Will Not Result in Exceeding the Dose Criteria for the Stated
RES-0 Units	This unit has not had radiation exposure.	Negligible Risk < 75 cGy Moderate Risk < 100 cGy Emergency Risk < 125cGy

RES-1 Units	The unit has been exposed to greater than 0, less than or equal to 75 cGy	Negligible Risk < 35 cGy Moderate Risk < 60 cGy Emergency Risk < 85 cGy
RES-2 Units	The unit has been exposed to greater than 75, less than or equal to 125 cGY	Any further exposure exceeds negligible or moderate risk
RES-3 Units	The unit has been exposed to greater than 125 cGy	All further exposure will exceed the emergency risk
Notes: Nuclear radiation exposure status (RES) guidelines specify units in centigray (cGy); however, the US Navy is required by the Code of Federal Regulations to conduct radiation monitoring in clasic radiation units such as R,rad, or rem. 1 cGy = 1-rad.		

- $$\text{Dtb} = \frac{\text{(OEG)} - \text{previous exposure}}{2}$$
- $$\text{Rtb} = \frac{2 \text{ X (OEG} - \text{Previous Exposure) X Speed}}{\text{Distance}}$$

(6) If the dosimeter reading indicates a turnback dose and the dose rate is still increasing, the unit should immediately leave the contaminated area by the same route it used to enter the area. If the dose rate is decreasing, the commander must decide whether to continue through the contaminated area (then return to the unit by a clean route) or immediately leave by the same route used to enter the area. This procedure is used to minimize exposure.

b. Categories of Exposure. Effective use of radiation exposure records permit rapid determination of a units potential to operate in a radiologically contaminated area. Dose criteria has been established in four categories (See Table D-1), Radiation Exposure Status (RES) 0-3. This information is based on the best available estimates on predicting the effects of radiation exposure.

c. Risk Criteria. The degree-of-risk concept helps the commander to establish an OEG for a single operation and minimize the number of radiation casualties. By using the RES categories (Table D-1) of subordinate units and the acceptable degree of risk, the commander establishes an OEG based on the degree of risk. There are three degrees of risk - negligible, moderate, and emergency (See Table D-2). Each risk can be applied to radiation hazards from enemy or friendly weapons, or both. Degrees of risk are defined in percentages of either casualties or performance degradation. A casualty is defined as an individual whose performance effectiveness has dropped by 25% from normal. Specific measures of performance depend upon the task. Degradation (nuisance) effects can range from vomiting, skin burns, and ear drum rupture to nausea. These symptoms, at low radiation levels, may take hours to develop. Individuals thus exposed should be able to function in the important hours after a nuclear attack and after the first set of symptoms abate. The casualty data presented in this section is based on a 50% confidence level that the unit is at a 75% performance decrement.

(1) Negligible Risk. Negligible risk is the lowest risk category. The dose is < 75 cGy for personnel in RES-0 (with no previous exposure). This dose will not cause any casualties. Personnel receiving a negligible risk dose should experience no more than 2.5 percent degradation (nuisance) effects. Negligible risk is acceptable when the mission requires units to operate in a contaminated area. Negligible risk should not be exceeded unless a significant advantage will be gained.

(2) Moderate Risk. Moderate risk is the second risk category. The dose is < 100 cGy for personnel in RES-0 (with no previous exposure). This dose generally will not cause casualties. Troops receiving a moderate risk dose should experience no more than 5 percent incidence of nuisance effects. Moderate risk may be acceptable in close support operations. Moderate risk must not be exceeded if personnel are expected to operate at full efficiency.

(3) Emergency risk is the final risk category. The dose is any exposure > 125 cGy. In this category, not more than 5 percent casualties are expected. Nuisance effects may exceed the 5 percent level. The emergency risk dose is only acceptable in rare situations, termed disaster situations. Only the commander can decide when the risk of the disaster situation outweighs the radiation emergency risk. The risk criteria for the RES-1 and RES-2

categories are based on assumed average exposures for units in RES-1 and RES-2. This should be used only when the numerical value of the total past cumulative dose of a unit is unknown. When the cumulative dose within a category is known, subtract the known dose from the RES-0 criteria for the degree of use of concern. For example if a unit in RES-1 received 30 cGy, it may receive an additional dose of 30 cGy before exceeding the moderate risk.

d. Low Level Radiation Guidance. In operational environments such as military operations other than war (MOOTW) situations, units are aware of possible low level radiation exposure (See Table D-2 for low level radiation guidance). Commanders actions follow the same previous guidance: eliminate or minimize exposure and monitor unit and personnel radiation exposure. Further, see Table D-3 for contamination control guidance for missions of 7 days or 90 days.

Table D-2. Military Operations Other Than War, Radiation Exposure Status

LOW LEVEL RADIATION GUIDANCE FOR MILITARY OPERATIONS		
Total Cumulative Dose (See Notes 1, 2, and 3)	**Radiation Exposure Status (RES) Category**	**Recommended Actions**
0 to 0.05 cGy	0	None
0.05 to 0.5 cGy	1A	Record individual dose readings. Initiate periodic monitoring.
0.5 to 5 cGy	1B	Record individual dose readings. Continue monitoring. Initiate rad survey. Prioritize tasks. Establish dose control measures as part of operations.
5 to 10 cGy	1C	Record Individual dose readings. Continue monitoring. Update survey. Continue dose ccontrol measures. Execute priority tasks only (See note 3).
10 to 25 cGy	1D	Record Individual dose readings. Continue monitoring. Continue dose control measures. Update survey. Execute priority tasks only (See note 4).
25 to 75 cGy	1E	Record Individual dose readings.

		Continue monitoring. Continue dose control measures. Update survey. Execute priority tasks only (See note 4).

Notes:

1. The use of the measurement millisieverts (mSv) is preferred in all cases. However, military organizations normally only have the capability to mesure centigray (cGy). If the ability to obtain measurements in mSv is not possible, US Forces will use cGy. For whole body gamma irradiation, 1 cGy = 1 mSv . The US Navy is required by the code of Federal Regulations to conduct radiation monitoring in classic radiation units such as R, Rad, or REM. 1cGy = 1 rad.
2. All doses should be kept as low as reasonably achievable (ALARA). This will reduce individual risk as well as retain maximum opeational flexilility for future employment of exposed pesons.
3. Examples of priority tasks are those that avert danger to persons, prevent damage from spreading.
4. Examples of critical tasks are those that save lives.

e. Radiation Exposure Records.

(1) The OEG concept requires that radiation exposure records be maintained by all units. Radiation exposure records are maintained at levels of command such as wing/shipboard/brigade/regimental level.

(2) The NBC staff maintains RES records for all assigned and attached units. The records are based on exposure data received daily or after a mission in a radiologically contaminated area. Unit SOP indicates specific reporting procedures. Monthly records are maintained according to unit SOP.

f. Processing Data.

(1) The data from flight/sections/platoons elements are passed to the applicable NBC control center. Readings from tactical dosimeters (AN/UDR-13, IM93s, or DT236s) are averaged on a daily basis, and an informal record is maintained at flight/section/platoon level. The IM93s, which work on the principle of the electrical collection of ions, are recharged after each report is submitted or every three days, whichever occurs first. The AN/UDR-13 can record total dose for a specific period of time. For the DT236, prior to nuclear operations, each unit will read 10 percent of the total number of DT236 weekly to ensure no leakage has occurred. After nuclear operations have commenced in the theater of

operations, one third of the total number of DT236s will be read daily. The DT236s have a response time of 24 hours and ± 30% accuracy. This is due to the process by which the DT236 records radiation levels (Note: the DT–236 is part of the AN/PDR-75).

(2) The preferred method of recording individual exposure is based on analysis of each person's dosimeter. However, situations may occur in which LLR individual dosimeters are not available for all potentially exposed personnel. In such situations, and when dosimeters become lost or damaged, specialist advisors should be consulted for acceptable alternative methods of assessing and recording individual exposures.

(3) Wing/ship/brigade or battalions record and maintain the status on each assigned or attached elements. An overall RES status is reported to the commander and his staff.

49. LOW LEVEL RADIATION

a. Introduction.

(1) Prior procedures for the management of radiation exposure basically assume that nuclear hazards will arise following a nuclear exchange; both procedures and equipment reflect this. There, however must be concern for both the immediate employment of personnel (survive to operate) and their combat capability and the health effects on individuals.

(2) Radiation hazards could emanate from sources other than a nuclear weapon burst and in circumstances other than strategic attack (general war), including operations other than war situations. Although, in some circumstances, the radiation exposures could be high (i.e. >70cGy) and result in short term medical effects among the exposed personnel, it is accepted that much lower dose levels are more likely to be encountered in future operations.

(3) The purpose of this section is to provide guidelines to the commander for the protection of personnel during military operation in LLR environments while at the same time maintaining, as far as possible, the operational capability of the deployed force.

Table D-3. Contamination Control Guidance
(For up to a 7 day mission or Within a 90 Day mission)

Radiation Exposure State (RES)	Contamination Level Below Which RES Will Not Be Exceeded Bq/cm^2		
	Equipment And Protective Clothing[1]		Skin[3]
	High Toxic Alpha Emitters[2]	Beta And Low-toxic Alpha Emitters	Beta Only
Category 1 A 0.05 – 0.5 cGy	5 (7d)[5] 0.5 (90d)	50 (7d) 5 (90d)	10 (Up to one event[4])
Category 1 B 0.5 – 5 cGy	50 (7d)[5] 5 (90d)	500 (7d) 50 (90d)	10 (10 events[4])
Category 1 C 5 – 10 cGy	100 (7d)[5] 10 (90d)	1000 (7d) 100 (90d)	10 (20 events[4])
Category 1 D 10 – 25 cGy	250 (7d)[5] 25 (90d)	2500 (7d) 250 (90d)	10 (50 events[4])
Category 1 E 25 – 70 cGy	700 (7d)[5] 70 (90d)	7000 (7d) 700 (90d)	10 (50 events[4])

Notes:
1. Calculations assume contamination is removal by decontamination.
2. All Alpha-emitting isotopes, except uranium, are assumed to be highly-toxic.
3. Handling of contaminated equipment without wearing protective clothing is allowed only when the contamination levels do not exceed those of Category 1-A.
4. The number of brackets refers to the maximum allowable number of contamination events that can occur, regardless of where on the body each contamiantion appears. Decontamination must be performed as soon as possible after each event. Each event may involve multiple sites.
5. The term (7d) refers to 7 days; the term (90d) refers to 90 days.

b. Definitions. The following definition is used to define LLR: Radiation resulting from any cause other than the immediate nuclear radiation and subsequent direct radioactive fallout from the detonation of a nuclear weapon.

c. LLR Characteristics.

(1) LLR is always present as background radiation; it varies considerably throughout the world and can even vary considerably within a small locality. It complicates detection quantification and hence interpretation of a LLR Hazard.

(2) LLR may be comprised of dispersed radioactive material (in solid, liquid, gaseous or vapor form) or it may be in the form of discrete sources. Alpha, beta, gamma and neutron radiation all may present LLR hazards.

(3) Alpha radiation has a very limited range in air (centimeters), and is not able to penetrate clothing or intact skin. Alpha radiation emitting material represents no hazard while outside the body, but in sufficient quantity, can deliver large radiation doses to individual organs and may become a serious health hazard if ingested or inhaled.

(4) Beta radiation has short range in air (meters), are attenuated by clothing and can be stopped by relatively thin layers of most solid materials. Beta radiation-emitting material represents a hazard if inhaled or ingested and may result in high skin doses from external exposures that can manifest into “Beta Burns”. Most radioactive materials emit both beta radiation and gamma radiation.

(5) Gamma radiation has a long range and is easy to detect, but may be absorbed and diminished in intensity by dense materials (shielding). Gamma radiation emitting material is able to deliver radiation doses to the "whole body" while remaining outside the body.

(6) Neutron radiation is penetrating but may be diminished by interacting with low atomic-number materials. Such interactions may result in the production of gamma radiation, thus producing multiple types of radiation hazards. Neutron radiation-emitting material is able to deliver radiation doses to the "whole body" while remaining outside the body.

d. LLR Sources.

(1) Civil Nuclear Facilities. These facilities may include those for power generation, research and for the processing, storage and disposal of nuclear waste.

(2) Industrial and Medical. Wide scale use of radioactive sources include the testing of industrial products, medical or diagnostic treatment and equipment sterilization and food processing.

(3) Radiological Dispersal Weapons. Devices designed to release radioactive materials into the environment. This could be achieved by combining nuclear materials with conventional explosives or combustion to produce radioactive particles or smoke.

(4) Nuclear Weapon Release. The spread of fallout or rainout resulting from the distant (outside Area of Operations) or earlier use (within Area of Operations) of Nuclear Weapons.

(5) Military Commodities. Some military munitions (e.g. Depleted Uranium) and equipment contain radiation which if disrupted may present a radiation hazard.

e. Risk Management.

(1) Radiation exposure control measures will reflect the need to balance the duty of care to individuals (recognizing both immediate potential hazards, as well as, risks to longer-term health effects) against the achievement of the military task which might, of itself, involve life-threatening activities. Consequently, when planning or implementing operations where LLR may be, or may become, a factor for consideration, commanders must be capable of making informed and balanced judgments between their operational obligations, at the time, and their duty of care responsibilities. Further, the over-riding principle governing all exposure to radiation is keep such exposure to "As Low As Reasonably Achievable".

(2) Tables D-2 and D-3 provides LLR exposure guidance to commanders. It shows radiation exposure categories and associated doses and recommends actions appropriate to mitigating the risk to individuals. Although the dose contributed by ingestion or inhalation of radioactive material (known as internal dose), by partial body irradiation’s from gamma

rays and by skin irradiation's from beta particles cannot be accurately measured in the field, it can be estimated for operational purposes. Depending upon the type of radioactive material and its dispersed form, the effective dose equivalent or the committed dose may be much larger than the external dose recorded on a dosimeter. Consequently, respiratory and skin protection must be considered whenever the hazard analysis establishes that there is a potential risk for exceeding exposure guidance standards.

(3) Military operations may require that national peacetime regulations governing exposure be exceeded; this may be the case particularly in humanitarian, life-saving and/or emergency situations. All exposure to radiation must be justified by necessity and subjected to controls that maintain doses as low as reasonably achievable. Some of the controls can include:

- Inform the local civil authorities.
- Call for specialist monitoring team.
- Make an estimate and plan of the control measures necessary to contain the LLR hazard. This should include: adherence to commander's OEG limits; further evacuation of hazard area, if required; and controlled access.
- If LLR detection equipment and trained personnel are available, conduct a survey and confirm the extent of the LLR hazard.
- Monitor exposure of personnel who for operational reasons must remain within the hazard area. These measures will be the responsibility of the commander.
- Dosimeters, if available, should be issued. Forces adopt respiratory and skin protection until analysis establishes that there is no potential risk for exceeding internal or skin exposure guidance standards.
- Prevent further access into the defined hazard area and consider OEG guidance, and/or decontamination sites as necessary.
- Ensure that food and water from the area is uncontaminated if it is to be used.
- Review procedures for limiting the resuspension of ground contamination, if appropriate.

f. Contamination Control Considerations. The planning for contamination control can include the following considerations –

- Confirmation of the authorized dose limits and the adequacy of exposure control measures for forces remaining within the hazard area for operational reasons. Where dosimeters have not already been issued, the level of dose and exposure time will have to be estimated and recorded.
- Decontamination in order to render safe the personnel and equipment leaving hazard area (specialist advice and monitoring equipment may be required depending on the nature of the contamination).
- Reconnaissance and survey to confirm and mark the area, and nature and intensity of the hazard. Monitoring should continue until operations in that area are concluded.

g. LLR Planning. After assessment, LLR planning addresses the following considerations:

- The nature and potential extent of any identified risks including a description of the possible accident or incident scenarios.
- Identification of what RADIAC detection equipment is immediately available in the area of operation and, therefore, what LLR hazard can be detected.
- The immediate and control actions (including advisory dose limits and the circumstances and authority required to exceed each incremental dose limit) appropriate to current local conditions.
- The issue of available equipment (including dosimeters, spectrometer, decontamination and medical measures).
- Means of assessing national technical advice and support to extend the detection/monitoring capabilities in the area of operation.
- Arrangements for obtaining further specialist personnel and equipment; such as coordinating for teams that would be prepared to sample and identify radiological agents.
- The informing and training of personnel.

h. LLR Hazard Avoidance Considerations. When in the area of operation, commanders should avoid exposing their personnel to LLR hazards by taking the following measures:

- Obtain information regarding potential hazard areas.
- Be aware of host nation nuclear facilities and other possible radioactive sources and respect their installation control measures.
- Restrict and closely control entry to areas marked by radioactive warning signs.
- Ensure troops do not tamper with containers marked with radiological warning signs.
- Treat all suspect waste dumps and potential hazard sites with care until proven clear.

i. LLR Protection Considerations. Initial Action. When a hazard is identified, the following actions should be taken:

- If the situation permits evacuate military personnel from the area of release if it is confined (e.g. inside hospital building), otherwise evacuate the area to a radius as determined by onscene personnel, taking into account the current military situation. As an immediate guide, evacuation can be to distances where operationally significant radiation levels (ten times natural background readings at 1 meter above the ground) no longer exists. In the absence of any specific guidance, or when under unusual or unforseen constraints, evacuation to a radial distance of 1 km from the suspected radiation release point may be employed.
- Report the hazard verbally and by using NBC reports.
- The need and the means to report the hazard, including the warning of other forces and the host nation.
- Ensure availability of specialists to establish the exact nature of the LLR hazard, the extent of contamination and long term plan of action.

j. LLR Force Health Protection Considerations. Force health protection considerations include:

- Record LLR exposure on personal medical records for long-term health monitoring. This will involve the medical chain.
- Continue to accurately monitor LLR dose rates.
- Contain and secure the hazard. Obtain samples for detailed analysis and identification.
- On completion of the military operation, long term health monitoring may be required for those personnel who have been exposed to radiation. Post operations assessment of internal doses may also be required.

k. LLR-Psychological Casualties.

(1) Psychological casualties would seem to be insignificant compared to the casualties from physical trauma, but they can dramatically alter the outcome of an operation. The neuropsychiatric casualties of World War II were the largest single cause of lost military strength in that war. Complicating matters further, psychological stress can mimic the early symptoms and signs of acute radiation injury. Gastrointestinal symptoms (nausea, vomiting and diarrhea), fatigue, and headaches were frequently seen symptoms during episodes of *battle fatigue* in World War II. In radiation dispersal device (RDD) or nuclear incident scenarios, psychological stress is also a factor. Even if neuropsychiatric trauma does not produce a casualty, it can degrade the performance of normal duties. Slightly altered reaction times, attention, or motivation have important consequences across the entire spectrum of military operations. Regardless of the situation, it must be emphasized that the most extreme psychological damage occurs when physiological symptoms from an unknown toxic exposure become manifest.

(2) The use of an RDD or a nuclear incident would be expected to likely produce acute anxiety effects, including psychosomatic effects such as nausea and vomiting. Symptoms of acute radiation sickness in just a few personnel might trigger an outbreak of similar symptoms in the unit and/or in the civilian populace.

(3) Exposure, or perceived exposure to radiation can be expected to increase the number of psychological stress casualties. The number of casualties will also depend on the level of leadership, cohesiveness, and morale in the unit. Long-term chronic psychological stress patterns could be expected to arise from the uncertainty about the effects of exposure to radiation. Some of the potential effects include phobias, depression, and post traumatic stress disorder.

(4) The most frequent psychological effect after disasters is a temporary emotional disruption where people are stunned or dazed. This transient response may last minutes to

days. Typically, such individuals will be able to respond to strong leadership and direction. Another psychological response is to become more efficient in the face of danger; this is more likely in well-trained units with high morale. A third type of response would be that of a psychological casualty, where the transient emotional disruption is continued and more severe. Reactions include stunned, mute behavior, tearful helplessness, apathy, inappropriate activity, and preoccupation with somatic symptoms (often of emotional origin).

(5) The most stressful effects of a fallout field or contaminated area are likely to be the uncertainties of the levels of radiation present, lack of defined boundaries of the area, and the perceived acute and chronic effects of radiation.

(6) Even in the absence of actual exposure, fear that one has been exposed to radiation may cause psychosocial sequelae. Since fear and anxiety are stressors, the person may experience psychosomatic symptoms.

(7) The treatment of psychological stress resulting from actual or perceived exposure to radiation is the same as that for battle fatigue. The principles of proximity, immediacy, expectancy, simplicity are the cornerstones of treatment.

(8) Prevention, when possible, is always preferred to treatment. Prior to deployment to an area where nuclear and radiological hazards are present, medical personnel can implement programs on behalf of line commanders that instruct their units about radiation and its effects. In general, personnel who are psychologically prepared for specific stresses are better able to endure them and will suffer fewer and less severe adverse reactions. This same principle is widely used in preparing troops to cope with MOPP gear, chemical agent exposure, and other adverse environments. Postexposure training will be much less effective.

50. DEPLETED URANIUM

a. Depleted uranium (DU) is an extremely dense metal used in munitions to penetrate heavy armor or as protective shielding (armor packages). DU is also used as equipment components.

b. DU Depleted uranium exposure and incidents may occur anytime there is damage to the DU armor package, a vehicle is hit with DU munitions, DU munitions are damaged, or equipment components containing DU are damaged. The DU armor can be damaged during vehicle maneuvers, on-board fires, maintenance activities, or ballistic impacts. DU munition problems may occur as an occupational exposure during storage, transportation, combat, testing, or manufacturing. DU contamination may be present on the ground in areas where equipment was destroyed or damaged.

c. DU contamination may include DU oxides (dust), contaminated shrapnel, munitions components, or armor components. DU emits primarily alpha particles; however, beta, gamma, and x-ray ionizing radiation are also emitted. DU contamination could be inhaled, ingested, injected, or absorbed through open cuts or wounds. DU contamination does not pose an immediate health risk. Consequently, contamination should be removed from personnel or vehicle surfaces when directed by the unit commander based on METT-TC. See Table D-4 for information on recommended maximum permissible contamination levels.

d. Visual signs that DU contamination is present include heavy, dull-black dust or small round holes. DU contamination can only be verified with a radiacmeter. An AN/VDR-2 or AN/PDR-77 with an alpha probe or beta (flat pancake) probe (RPO kit) is used to detect and measure DU contamination.

e. When working on or within DU contaminated equipment, personnel wear gloves, use respiratory protection (i.e., painters mask, bandana, surgical mask, etc); and wear coveralls or they can roll down their sleeves and blouse their trousers as directed by unit chemical or medical personnel.

f. General procedures to follow when working around DU include:

- Use a radiac to determine if DU contamination is present.
- Provide protection, including appropriate clothing, for workers as directed by unit NBC or medical personnel.
- Identify what is to be decontaminated.
- Obtain necessary equipment and materials.
- Brush, wash, or wipe off contamination with a damp cloth. Use a HEPA filtered vacuum cleaner if available.
- Work from the outside of the contaminated area to the inside.
- Cover fixed contamination with tape, paint, paper, plastic, or other disposable material.
- Use the standard double bag and tag process for hazardous waste. The only contaminated waste generated by DU will be the vacuum-cleaner bags after use on multiple vehicles.

Table D-4. Recommended Maximum Permissible Contamination Levels

Contaminated Item	Corrective Action	Maximum Alpha		Maximum Beta	
		Fixed[1] (dpm/100 cm2)	Removable[2] (dpm/100 cm2)	Fixed[1] (mrad/hr at 2.5 cm)	Removable[2] (dpm/100 cm2)
1. Personal clothing including shoes	See note 1	200	None	0.05	None
2. Personal clothing: a. General b. Respirators c. Laundry	 See note 1 See note 1 See note 2	 1,000 200 --	 200 None --	 0.02 0.06 --	 1,000 None --
3. Work area and equipment (unrestricted use)	See note 1	5,000	500	0.05	500
4. Vehicles (unrestricted use)	See note 3	1,000	500	0.05	500
5. Skin a. Body b. Hands	 See note 4 See note 4	 200 400	 None None	 0.06 0.06	 None None

[1] Measured with a calibrated radiation measurement instrument. [2] Determined using smears analyzed with a calibrated counting system. Notes: 1. Replace or dispose of radioactive waste if above limits. 2. Release only to NRC licensed launderer, if contaminated, or dispose as radioactive waste. 3. Decontaminate if above limits. 4. Continue decontamination if above.

Appendix E

TOXIC INDUSTRIAL CHEMICALS AN ASSESSMENT OF NBC FILTER PERFORMANCE

36.

51. BACKGROUND

37. This appendix provides information and data on the assessment of NBC filter performance as they relate to protection against selected TICs. The filter performance data only provides supporting technical information for NBC planners. The TIC protection actions described in Chapter II remain as the primary basis for a response to an incident or accident. The most important action in case of massive TIC/TIM release is immediate evacuation outside the hazard's path. The greatest risk from a large-scale toxic chemical release occurs when personnel receive little or no warning, are unable to escape the immediate area, and are overcome by vapors. Units use the US Department of Transportation, North American Emergency Response Guidebook (ERG) to identify protection requirements for specific material. The protective mask and ensemble and military standard collective protection filters will likely provide only limited protection.

52. ASSESSMENT OF FILTER PERFORMANCE

a. Background.

(1) This assessment applies to multiple sets of NBC filters (e.g., C2A1 Canister; M12A2 Gas Filter; M18 Gas Filter; M49 Gas Filter; M48 Filter; M23 Filter; 200cfm filter; AICPS Filter). The fact that US NBC filters are designed to process equivalent amounts of chemical per quantity of activated carbon enables the performance of specific filters to be estimated from a single filter configuration.

(2) NBC filtration systems consist of a particulate filter to remove liquid and solid phase toxic particulate materials followed by a vapor filter to remove vapor phase toxic chemicals. The vapor filter consists of activated carbon, which has been impregnated with reactive materials. This impregnated; activated carbon filters vapors by two mechanisms,

physical adsorption in the pores of the activated carbon and chemical reaction with the impregnants. Low vapor pressure chemicals such as the nerve and mustard agents are removed very effectively by physical adsorption alone in the microporous structure of the carbon. Relatively high vapor pressure agents such as the blood agents (cyanogen chloride and hydrogen cyanide) are not strongly physically adsorbed and will quickly penetrate a non-reactive activated carbon. Thus, specific reactive chemicals have been identified which chemically decompose those high vapor pressure agents. These reactive chemicals are impregnated on the activated carbon so as to provide effective filtration of all chemical warfare agents.

(3) Chemical warfare agent vapor filters contain the reactive adsorbent ASC carbon (which is a coal-based, activated carbon impregnated with salts of copper, silver and chromium) or ASZM-TEDA carbon (a chromium-free carbon). The protection provided by these two sorbents against chemical warfare agents is nearly equivalent. Both ASC carbon and ASZM-TEDA carbon were developed specifically to filter chemical warfare agent vapors. However, the adsorbents would also be effective in filtering a wide variety of industrial chemical vapors, particularly those that are strongly adsorbed.

b. TIC NBC Filter Assessment.

(1) Historically, CW agents have consisted primarily of analogs of nerve, mustard, cyanide, and arsine, as well as a number of industrial-type chemicals such as chlorine, phosgene, and chloropicrin. Of the tens of thousands of TICs produced worldwide, There are many that present an aerosol hazard and are produced in large quantities. A tri-national group (US, Canada, United Kingdom) evaluated researched the broad issue of industrial based chemicals, and the study effort resulted in identification of selected TICs that are widely produced, stored, and transported; easily vaporized; and are highly toxic (see Table E-1).

Table E-1. List of Selected TIC

Ammonia - P	acetone cyanohydrin - M	allyl isothiocyanate - E
Arsine - E	Acrolein - P	arsenic trichloride - M
boron trichloride - E	Acrylonitrile - P	Bromine - P
boron trifluoride - E	allyl alcohol - M	bromine chloride - M
Carbon disulfide - P	allyl amine - P	bromine pentafluoride - M
Chlorine - E	allyl chlorocarbonate - M	bromine trifluoride - M
Diborane - E	boron tribromide - M	carbonyl fluoride - P
Ethylene oxide - P	carbon monoxide - P	chlorine pentafluoride - M
Fluorine - E	carbonyl sulfide - P	chlorine trifluoride - M
Formaldehyde - P	Chloroacetone - M	Chloroacetaldehyde - M
Hydrogen bromide - E	Chloroacetonitrile - M	chloroacetyl chloride - M
Hydrogen chloride - E	chlorosulfonic acid - E	Cyanogen - E
Hydrogen cyanide - E	Crotonaldehyde - M	diphenylmethane-4 diisocyanate - E
Hydrogen fluoride - E	Diketene - M	ethyl chloroformate - M
Hydrogen sulfide - E	1,2-dimethyl hydrazine - P	ethyl chlorothioformate - E
nitric acid, fuming - E	dimethyl sulfate - E	ethylene imine - P
Phosgene - E	ethylene dibromide - M	Ethylphosphonothioicdichloride - E
Phosphorus trichloride - E	hydrogen selenide - P	ethyl phosphonous dichloride - M
sulfur dioxide - E	iron pentacarbonyl - M	Hexachlorocyclopentadiene - E
Sulfuric acid - E	methanesulfonyl chloride - E	hydrogen iodide - P
Tungsten hexafluoride - E	methyl bromide - P	isobutyl chloroformate - M
	methyl chloroformate - P	isopropyl chloroformite - M
	methyl chlorosilane - P	n-butyl chloroformate - M
	methyl hydrazine - M	nitric oxide - P
	methyl isocyanate - P	n-propyl chloroformate - M
	Methyl Mercaptan - P	Isopropyl - P
	n-butyl isocyanate - M	Parathion - E
	nitrogen dioxide - P	perchloromethyl mercaptan - E
	Phosphine - M	sec-butyl chloroformate - M
	trichloroacetyl chloride - M	sulfuryl fluoride - P
	phosphorus oxychloride - M	tert-butyl isocyanate - M
	phosphorus pentafluoride - P	tetraethyl lead - E
	selenium hexafluoride - E	tetraethyl pyrophosphate - E

Table I-1. List of Selected TIC (Continued)

	silicon tetrafluoride - P	tetramethyl lead - M
	Stibine - P	toluene 2,4-diisocyanate - E
	sulfur trioxide - M	toluene 2,6-diisocyanate - E
	sulfuryl chloride - P	
	tellurium hexafluoride - P	
	tert-octyl mercaptan - E	
	titanium tetrachloride - E	
	Trifluoroacetyl chloride - P	
Legend: - Effective (E); Marginally (M); Poor (P).		

(2) The listing of the TICs represents a broad range of physical and chemical properties. Chemical families consist of halides (fluoride, chloride, bromide, and iodide), cyanides, cyanates, amines, oxides of carbon and nitrogen, ketones, aldehydes, esters, phosphates, thiols, and heavy metals (lead, titanium). This information shows that about 75 percent of the chemicals have a vapor pressure above 10 mm Hg, a state at which the strength of physical adsorption is reduced more rapidly on activated carbon and is a greater concern with respect to desorption.

(3) Tables E-1 provides in summary form the results of the assessment of the protection afforded by NBC filters to the selected TICs. The filter assessment indicated that many of the TICs were assessed to be removed by the filter (effective); minimal removal (poor); or partial removal (marginal). However, variables such as being near the explosive and meteorological conditions could each affect the assessment. Several of the TICs were effectively removed by NBC filters; however, almost equal numbers were assessed as performing poorly (P) or marginally (M).

(4) Table E-1 only provides data to support unit planning. For example, this data could be used to support risk assessments based on IPB evaluation. (i.e., types of TICs found in an area of interest) furnished by the intelligence officer. However, military units (except for special purpose units like EOD or hazardous materials response teams) lack the capability to detect most TICs; and the unit response to TIC incidents/accidents remains as described in Chapter II.

NOTE: This summary only addresses several of the TICs that represent an aerosol hazard and are produced in large quantities. There are many other TICs that present other hazards- flammability, oxygen depleting, etc. Consult the North American ERG for specific information on TIC hazards, safety considerations, and other applicable emergency response guidelines.

Appendix F

NONCOMBATANT EVACUATION OPERATIONS

38. This appendix provides an overview of Noncombatant Evacuation Operation (NEO) and provides information that could be used to support military unit planning and noncombatant evacuees (NCE).

Note: The information provided in this appendix is very general. Specific details will vary depending on individual situations, and detailed prior planning by commanders will help support successful mission execution.

53. FUNCTION

39. Military planners recognize the importance of NEO and its direct link to successful mission accomplishment. Military planners involved in the NEO planning and execution consider several aspects affecting its potential implementation.

- All American citizens should be treated equally.

- While US citizens do have evacuation priority; NEO execution may also involve support to NCE who are not US citizens. Other nations are expected to request evacuation support from the US Department of State (DOS). Upon DOS approval, third country nationals (TCN) from countries who have been authorized assistance will be included in NEO processing.

- NEO support planning covers the response to any crisis that could lead to a decision to direct an ordered evacuation.

54. FOCUS

40. The primary focus of NEO is to move NCE safely and quickly away from danger.

55. STAGES OF NEO

a. Alert. NCE will be notified of an impending crisis that may require relocation or evacuation and be provided appropriate instructions from commanders through their installation NEO representatives.

b. Assembly. Following receipt of instructions to assemble, NCE will move to an Evacuation Control Center (ECC). Some NCE may be instructed to stand fast in their quarters or existing shelter for a period in order to minimize risk and ensure a managable flow into the evacuation system.

c. Relocation. The movement of NCE to another location is called relocation. Relocation will be conducted to move NCE from ECCs to sites of greater relative safety called relocation centers (RC) or aerial ports of debarkation (APOD) where they will board transportation.

d. Evacuation. The movement of NCE from an area to a safe haven is called evacuation.

e. Repatriation. Upon arrival in CONUS, NCE are repatriated.

56. NEO OPERATIONS IN A NBC ENVIRONMENT

41. The intent of this paragraph is to clearly outline the hazards facing NEO personnel in a contaminated environment, and describe individual survivability methods (with and without specialized equipment).

a. Planning Considerations. The following planning considerations may apply; however, each NEO situation will be different.

(1) The majority of airlift NEO evacuations may take place during retrograde timed phase force deployment data (TPFDD) operations (i.e., the aircraft will download the military forces and equipment they brought to the APOD, load NEO passengers and equipment as necessary, and depart for a location outside of the immediate threat area).

(2) Some NEO personnel may be present at APODs during attack situations.

(3) The majority of NEO personnel will probably not have respiratory protection and/or protective overgarments.

b. Transforming Living Quarters or Other Facilities into NBC Protective Shelters.

(1) Certain key things must be understood concerning the nature of NBC agents and their interaction with the environment when planning the transformation of facilities into protective shelters for NEO personnel.

(2) In most cases, hazardous CB agent vapors will remain relatively low to the ground. Consequently, shelters established on the second or third floors of buildings will typically be safer from CB agents than locations on the ground floor.

(3) When transforming areas into protective shelters, consider the following factors and select the area based on –

- Size requirements (number of people expected to use the shelter and expected duration of stay).
- Access to telephone.

- Access to running water, cooking facilities, etc.
- Distance above ground level (higher the better).
- Distance from nearest vegetation (further the better).
- Realistic number of "vapor barriers" that can be constructed between shelter area and ground level.
- Number and location of "agent access" points to the inside of the facility i.e., doors, windows, fireplace, air vents.

(4) Cover and seal with tape all direct access points to the inside of the facility (fireplace, external air vents, etc.).

(5) Select one entry/exit point for the facility.

- If possible, use the entry/exit point that has the most concrete or asphalt (minimum soil or vegetation) immediately around it.
- Lock all other doors – leave keys in the door in case emergency escape is necessary.
- Create a decontamination station just inside the entry/exit door. This station must include bleach in containers (troughs) personnel can step into and hand buckets (for glove and/or hand decontamination). It should also have a container for contaminated asset disposal and a sharp knife or pair of scissors for cutting contaminated assets off of personnel.

(6) Provide splinter protection by taping windows (to minimize splintering), and then boarding up the windows with plywood, cardboard or some other suitable material.

(7) Use a substance such as duct tape to seal all potential agent access areas (doors, windows, openings around window air conditioners, etc.).

(8) Create artificial vapor barriers by taping large plastic sheets to walls inside hallways, top and bottom of stairwells, etc.

(9) Construct a personnel safety zone in the center of the living area (location where personnel will remain during attack situations). Accomplish this by –

- Creating a physical barrier between the personnel safety zone and the outside building wall by moving furniture items (dressers, chairs, book cases, etc.) around central "safe" area.

- Erect a tent or tent-type structure in the “safe” area. This structure will serve as the final protective layer during an attack situation. The object is to prevent physical contact with contamination, even if an explosion breaches the outer wall.

(10) Either turn off air conditioners/heating systems or ensure they can be turned off within seconds should an attack warning be received.

(11) Periodically determine the suitability of the air supply in the living area (amount and staleness). If necessary, when the shelter is known to be in an uncontaminated area, unseal an access point, let fresh air in, and reseal the access point.

(12) Ensure the following items are accessible –

- Decontamination buckets and materials (to include knife/scissors and asset disposal capability.
- Food and water supplies. This aspect of the operation is similar to hurricane or typhoon preparations. Personnel should have enough food and water to last at least 72 hours without requiring electric or gas cooking facilities.
- Fire extinguisher.
- Light sources (preferably flashlights with batteries).
- Clothing.

c. Protection afforded by Various Clothing Items. It’s important to realize clothing items other than specialized protective equipment will provide a degree of protection against agent contamination and exposure. The following are recommended clothing items to include levels and layers to aid in your protection.

(1) Clothing at Time of Attack. In order to maximize protection, NEO personnel should have at least two layers of clothing (in addition to underwear) on at the time of attack. This configuration would allow removal of contaminated outer garments while still retaining a degree of protection from contact with the agent or its vapors. Specifically, NEO personnel should adhere to the following concepts.

- Acquisition of respiratory protection is the utmost priority.

- If military issue protective masks are not available, NEO personnel should acquire commercially available carbon-filter, vapor protection masks (paint masks, pesticide delivery) – “dust” or “surgical” masks are insufficient.
- If no commercial masks are available, NEO personnel should fashion a close-knit material around their nose and mouth. The material should be wetted with water.
- The inner clothing layer should cover as much of the body as possible i.e., long pants and shirts versus shorts and T-shirts.
- The inner clothing layer should consist of dense and tight-weave fabrics (denim versus cotton knitted materials for example).
- The outer clothing layer should be a water-resistant material (i.e., poncho, raincoat, etc).
- The outer clothing layer should have as few seams, zippers, or buttons as possible. Each of these areas represents a weak spot in comparison to the remainder of the garment.
- A hood or hat should be worn to provide a degree of protection for the head area. The same concepts (dense, tight weave versus “open” construction) used for clothing also apply to the best choice of material.
- Gloves should be worn.
- Heavy, complete ankle coverage boots are the best choice. If available, outer heavy rubber construction rain boots should be worn over inner shoes. The inner shoes should have either rubber or hard leather soles.
- Garment openings (in between buttons or snaps, sleeve openings, etc.) should be taped shut. The garment should be taped over the top (gauntlet) of the gloves and the boots.

(2) During Transport from Shelter to Passenger Waiting Area/Aircraft. The same concepts expressed in paragraph (1), Clothing at Time of Attack, apply here. The exception is that NEO personnel should wear three layers of clothing over their underwear versus two. With these layers, two should be water-resistant (poncho or rain suit counts as a layer) over an inner layer of dense fabric, because personnel may be contaminated during the

transportation process (either contact or vapor absorption) from their shelter to the passenger waiting area.

(3) Recommended Clothing Preparation Activities. During the pre-attack stage, NEO personnel should double bag each set of clothing that offers protective capabilities but is not being worn and seal the closure with tape or a knot This will prevent the inadvertent loss of this clothing as a result of contamination breaching the shelter area.

d. Decontamination Operations.

(1) Given the possibility NEO personnel may not have access to specialized decontamination kits or equipment, they must be able to use readily obtainable items to accomplish required decontamination operations. Further, it is important that NEO personnel understand the basic tenants associated with contamination control operations. Specifically –

- Contamination avoidance is the best defense. Protecting personnel or materials by providing them cover (layers of clothing, double bagging, etc.) that prevents direct contact with the agent is the single most important factor.
- Recognize and understand the hazard. Personnel must be able to distinguish what chemical contamination looks like, and where it is likely to be.
- Immediately (within seconds) decontaminate exposed skin areas if necessary. Rapidly (within minutes) decontaminate clothing items, remembering that "removal" is an effective decontamination method.
- Keep as much distance between themselves and the contamination as possible. Use standoff decon systems such as a mop whenever possible. Never directly touch the contamination with exposed skin.
- Routinely "cleanse" gloves by dipping them in decon buckets containing 5% solutions of chlorine (undiluted household bleach) and following with a clear water rinse (just a couple of seconds in each).

- Military detectors will be used, if available, to verify effectiveness of decontamination operations. Recognize that a vapor hazard, however small, may still exist even though M8 or M9 detection paper readings are negative.
- Whenever possible, remove the hazard. For example, if a chair was the only thing contaminated in a room (due to a breach through a broken window for instance), the best option might be the removal of the chair.

(2) Decontamination Methods. NEO personnel may use the following items to achieve reasonable decontamination results.

(a) Chlorine Solutions. A 5% chlorine solution (bleach) is an exceptionally effective decontaminating agent. Directly apply the chlorine solutions (undiluted household bleach) to the affected area and follow with a clear water rinse. Scrubbing of the area is generally not necessary. Use these bleach solutions in buckets and troughs for glove/foot decontamination operations.

(b) Removal of Items. Many times the safest decontamination is to remove the item. This is especially true of contaminated clothing.

(c) Miscellaneous Items. Personnel can use rags, paper towels, dirt, sawdust, or any other absorbent material to remove chemical contamination.

e. Attack response Actions for NEO Personnel.

(1) Before the Attack (Pre-Attack).

- Seek shelter by moving to the designated shelters.
- Protect unused food, clothing, and water supplies. Accomplish this by sealing the items in appropriate containers, double bagging, etc.
- Ensure personnel remain prepared according to the guidelines contained in the "Clothing At Time of Attack" paragraph.

(2) When Notified or During the Attack (Trans-Attack).

- Take cover in the central shelter area.
- Immediately decontaminate clothing and/or skin if contamination enters the shelter area.

(3) After the Attack. (Post-Attack).

- Remain calm. Check individuals for contamination and decontaminate as necessary.
- Check shelter area for contamination. Assess situation and either decontaminate or relocate as necessary.
- Seek medical attention as required.
- Verify the integrity and contamination status of the entire shelter "system". Do not venture outside. Reseal and/or repair items as necessary.

Appendix G

NBC DEFENSE EQUIPMENT DATA

42. Information in this appendix provides National Stock Numbers for **selected** items of NBC defense equipment. (see Figure G-1). The basis of issue (BOI) will depend on service specific authorization documents.

TABLE G-1. NBC DEFENSE EQUIPMENT

ITEM NOMENCLATURE	NSN	LIN	BOI / CMT*
CP CLOTHING ITEMS			
Aircrewman Cape,	8415-01-040-9018	A87412	
Apron, Toxicological Agent Protective	8415-00-281-7813 (S) 8415-00-281-7814 (M) 8415-00-281-7815 (l) 8415-00-281-7816 (XL)	A87412	
Bag, Chemical Protective Clothing	8465-01-216-6259		
Boots, Toxicological Agent Protective (TAP)	8430-00-820-6304 (Size 5) 8430-00-820-6303 (Size 6) 8430-00-820-6306 (Size 7) 8430-00-820-6302 (Size 8) 8430-00-820-6301 (Size 9) 8430-00-820-6300 (Size 10) 8430-00-820-6299 (Size 11) 8430-00-820-6298 (Size 12) 8430-00-820-6297 (Size 13) 8430-00-820-6296 (Size 14) 8430-00-820-6295 (Size 15		
Cover, Helmet, CP	8415-01-111-9028		
Coveralls, Toxicological Agent Protective: TAP, Nylon	8415-00-099-6962 (S) 8415-00-099-6968 (M) 8415-00-099-6970 (L) 8415-01-105-2535 (XL)	F33220	
Footwear Cover, CP	8430-01-118-8172 (S) 8430-01-021-5978 (L)		
Footwear Cover, Toxicological Agent (TAP)	8430-00-262-5295 (S) 8430-00-262-5297 (M) 8430-00-262-5296 (L)	F28473	

TABLE G-1. NBC DEFENSE EQUIPMENT (Continued)

ITEM NOMENCLATURE	NSN	LIN	BOI / CMT*
CP CLOTHING ITEMS (Continued)			
Gloves, Toxicological Agent Protective (TAP), Type 2S9	8415-00-753-6550 (XS) 8415-00-753-6551 (S) 8415-00-753-6552 (M) 8415-00-753-6553 (L) 8415-00-753-6554 (XL)	J70393	
Glove Set, CP , Butyl	8415-01-144-1862 (XS) 8415-01-033-3517 (S) 8415-01-033-3518 (M) 8415-01-033-3519 (L) 8415-01-033-3520 (XL		
Gloves, CP	8415-01-138-2497 (S) 8415-01-138-2498 (M) 8415-01-138-2499 (L) 8415-01-138-2500 (XL)		
Gloves, CP	8415-01-138-2501 (S) 8415-01-138-2502 (M) 8415-01-138-2503 (L) 8415-01-138-2504 (XL)		
Gloves, Men's	8415-00-268-8353 (S) 8415-00-268-8354 (L)		
Insert, Glove, CP	8415-01-138-2494 (S) 8415-01-138-2495 (M) 8415-01-138-2496 (L)		

TABLE G-1. NBC DEFENSE EQUIPMENT (Continued)

ITEM NOMENCLATURE	NSN	LIN	BOI / CMT*
CP CLOTHING ITEMS (Continued)			
Coat, Chemical Protective Woodland Pattern Coat	8415-01-444-1163 (S/XSHT) 8415-01-444-1169 (S/SHT) 8415-01-444-1200 (M/SHT) 8415-01-444-1238 (M/REG) 8415-01-444-1249 (M/LNG) 8415-01-444-1265 (L/REG) 8415-01-444-1270 (L/LNG)		
Trousers, Chemical Protective Desert Pattern Trouser	8415-01-444-5417 (S/XSHT) 8415-01-444-5504 (S/SHT) 8415-01-444-5506 (M/SHT) 8415-01-444-5893 (M/REG) 8415-01-444-5892 (M/LNG) 8415-01-444-5898 (L/REG) 8415-01-444-5900 (L/LNG)		
Overshoes, Mens	8430-01-317-3374 (3) 8430-01-317-3375 (4) 8430-01-317-3376 (5) 8430-01-317-3377 (6) 8430-01-317-3378 (7) 8430-01-317-3379 (8) 8430-01-317-3380 (9) 8430-01-317-3381 (10) 8430-01-317-3382 (11)		

	8430-01-317-3383 (12) 8430-01-317-3384 (13) 8430-01-317-3385 (14)		

TABLE G-1. NBC DEFENSE EQUIPMENT (Continued)

ITEM NOMENCLATURE	NSN	LIN	BOI / CMT*
CP CLOTHING ITEMS (Continued)			
Multipurpose Overboots (MULO), Overshoes, Men's Vinyl OG 7	8430-01-048-6305 (3) 8430-01-048-6306 (4) 8430-01-049-0878 (5) 8430-01-049-0879 (6) 8430-01-049-0880 (7) 8430-01-049-0881 (8) 8430-01-049-0882 (9) 8430-01-049-0883 (10) 8430-01-049-0884 (11) 8430-01-049-0885 (12) 8430-01-049-0886 (13) 8430-01-049-0887 (14)	N39848	
Coveralls, Chemical Protective	8475-01-328-3454 (S) 8475-01-328-3455 (M) 8475-01-328-3456 (L) 8475-01-328-3457 (XL)		
Footwear Covers, Liquid Contamination, SCALP	8430-01-364-3458 (S) 8430-01-364-3459 (M/L) 8430-01-364-3460 (XL/XXL)	F43154	
Clothing Outfit, Liquid Contamination, Poncho/TRSR/SCALP	8415-01-364-3320 (S) 8415-01-364-3321 (M/L) 8415-01-364-3322 (XL/XXL)	C20369	
Suit, Chemical Protective	8415-01-327-5346 (XXXS) 8415-01-327-5347 (XXS)		

	8415-01-327-5348 (XS) 8415-01-327-5349 (S) 8415-01-327-5350 (M) 8415-01-327-5351 (L) 8415-01-327-5352 (XL) 8415-01-327-5353 (XXL)		

TABLE G-1. NBC DEFENSE EQUIPMENT (Continued)

ITEM NOMENCLATURE	NSN	LIN	BOI / CMT*
CP CLOTHING ITEMS (Continued)			
Suit, Chemical Protective	8415-01-324-3084 (XXXS) 8415-01-324-3085 (XXS) 8415-01-324-3086 (XS) 8415-01-324-3087 (S) 8415-01-324-3088 (M) 8415-01-324-3089 (L) 8415-01-324-3090 (XL) 8415-01-324-3091 (XXL)		
Suit, CB Protective	8415-01-333-7577 (S) 8415-01-333-7578 (M) 8415-01-333-7579 (L) 8415-01-333-7580 (XL)		
Suit, CB Protective	8415-01-333-7573 (S) 8415-01-333-7574 (M) 8415-01-333-7575 (L) 8415-01-333-7576 (XL)		
Suit, CP	8415-01-214-8290 (M)		
Drawers; CP	8415-01-363-8683 (Size 26) 8415-01-363-8684 (Size 28) 8415-01-363-8685 (Size 30) 8415-01-363-8686 (Size 32) 8415-01-363-8687 (Size 34)		

	8415-01-363-8688 (Size 36) 8415-01-363-8689 (Size 38) 8415-01-363-8690 (Size 40) 8415-01-363-8691 (Size 42)		

TABLE G-1. NBC DEFENSE EQUIPMENT (Continued)

ITEM NOMENCLATURE	NSN	LIN	BOI / CMT*
CP CLOTHING ITEMS (Continued)			
Undershirt; CP	8415-01-363-8692 (Size 26) 8415-01-363-8693 (Size 28) 8415-01-363-8694 (Size 30) 8415-01-363-8695 (Size 32) 8415-01-363-8696 (Size 34) 8415-01-363-8697 (Size 36) 8415-01-363-8698 (Size 38) 8415-01-363-8699 (Size 40) 8415-01-363-8700 (Size 42		
PROTECTIVE MASKS			
Mask, CB	4240-01-143-2017 (XS) 4240-01-143-2018 (S) 4240-01-143-2019 (M) 4240-01-143-2020 (L)	M11895	
Mask, CB, M40 ME	4240-01-258-0061 (S) 4240-01-258-0062 (M) 4240-01-258-0063 (L)	M12418	
Mask, CB, M40A1	4240-01-370-3821 (S) 4240-01-370-3822 (M) 4240-01-370-3823 (L)	M12418	
Mask, CB, ICV M42	4240-01-258-0064 (S)	M18526	

Mask, CB, ICV M42	4240-01-258-0065 (M) 4240-01-258-0066 (L)		
Mask, CB, M42A1	4240-01-369-7854 (S) 4240-01-370-2622 (M) 4240-01-369-7855 (L)	M18526	
Mask, CB, CV M42A2	4240-01-413-4100 (S) 4240-01-413-4101 (M) 4240-01-413-4102 (L)	M18526	

TABLE G-1. NBC DEFENSE EQUIPMENT (Continued)

ITEM NOMENCLATURE	NSN	LIN	BOI / CMT*
PROTECTIVE MASKS (Continued)			
Mask, CB, M43	4240-01-208-6966 (S) 4240-01-208-6967 (M) 4240-01-208-6968 (L) 4240-01-208-6969 (XL)	M12350	
Mask, CB, M43, UN	4240-01-265-2677 (S) 4240-01-265-2678 (M) 4240-01-265-2679 (L) 4240-01-265-2680 (XL)	M12350	
Mask, CB, M43A1, N	4240-01-319-5365 (S) 4240-01-320-8949 (M) 4240-01-319-5364 (L) 4240-01-319-5366 (XL)	M18594	
Mask, CB, M43A1, UN	4240-01-319-5367 (S) 4240-01-319-5368 (M) 4240-01-319-5369 (L) 4240-01-319-5370 (XL)	M18594	
Mask, CB, M45	4240-01-414-4034 (XS) 4240-01-414-4035 (S) 4240-01-414-4051 (M) 4240-01-414-4052 (L)	M12736	

Mask, CBAA, M48	4240-01-386-0198 (S) 4240-01-386-4686 (M) 4240-01-386-0201 (L) 4240-01-386-0207 (XL)	M 13515	
Mask, CB, General Avn, M49	4240-01-413-4099 (S) 4240-01-413-4095 (L) 4240-01-413-4096 (M) 4240-01-413-4097 (XL)	M 13583	
Mask, Chemical Biological	4240-01-175-3443 (3 sizes)		

TABLE G-1. NBC DEFENSE EQUIPMENT (Continued)

ITEM NOMENCLATURE	NSN	LIN	BOI / CMT*
PROTECTIVE MASKS (Continued)			
Mask, Chemical Biological	4240-01-284-3615 (S) 4240-01-284-3616 (M) 4240-01-284-3617 (L)		
Tester Kit, Protective Mask	4240-01-284-3615 (S) 4240-01-284-3616 (M) 4240-01-284-3617 (L)	T62350	
PROTECTIVE MASK ASSOCIATED PARTS & ITEMS			
Carrier, Field Chemical Biological	4240-00-933-2533		
CHEMICAL AGENT DETECTORS			
Automatic Chemical Agent Alarm	6665-01-105-5623	A32355	
Alarm, Chemical Agent, Automatic	6665-01-438-6963	A33020	
Chemical Agent Monitor	6665-01-199-4153	C05701	
Monitor , Chemical Agent	6665-01-357-8502	C05701	
Detector Kit, Chem Agent	6665-01-133-4964	G04300	
Detector Kit, Chemical Agent	6665-00-903-4767		
Detector Paper, Chemical Agent	6665-00-050-8529	N65648	
Detector Paper, Chem Agent	6665-01-226-5589		
Water Test Kit, Chemical Agent	6665-01-134-0885		

MISCELLANEOUS ITEMS			
Sign Kit, Contamination	9905-01-346-4716		
Sign Kit, Contamination	9905-12-124-5955 (NATO)		
DECONTAMINATION ITEMS			
Decon Kit, DKIE, M280 (20Kt/BX) 3 packets/kit	4230-01-206-4252		
Decon Kit, Skin M291 (20Kt/BX) 6 packets/kit	6850-01-276-1905		
Decon Kit, M295 (20 Kit/Box)/Individual	6850-01-357-8456		
Decon Apparatus	4230-00-720-1618	F81469	
Decontaminating Agent, DS2, 1-1/3 quart	6850-00-753-4827		

TABLE G-1. NBC DEFENSE EQUIPMENT (Continued)

ITEM NOMENCLATURE	NSN		BOI / CMT*
DECONTAMINATION ITEMS (Continued)			
Decon Apparatus, (DAP), 14L, M13	4230-01-133-4124	D81537	
Decontaminating Agent, DS2	4230-01-136-8888		
Decontaminating Agent, DS2, 5 gallon	6850-00-753-4870		
STB, 50 lbs., Decontaminating Agent	6850-00-297-6653		
Decon App, M17	4230-01-251-8702	D82404	
Decon App, M17	4230-01-303-5225	D82404	
Decon App, M17	4230-01-346-1778	D82404	
	4230-01-346-3122		
Power Driven Decon Apparatus, SANATOR, A/E-32U-8	4230-01-153-8600	D82404	
Decon App, Skid Mounted, M12A1	4230-00-926-9488	F81880	
Pump Unit, Centrficial	4320-00-752-9466		
Pump Unit, Centrficial	4320-01-338-8010	P91756	
COLLECTIVE PROTECTION			
Collective Protection, Equipment	4240-01-166-2254	C79000	
Entrance, Protective Pressurized	4240-01-202-0467		

Liner, Room Pkg.	4240-01-200-4326		
Collective Protection Equipment, XM 28	4240-01-330-7806	C79000	
Collective Prot Eq: M28	4240-01-330-7807	C52916	
Collective Prot Eq: M28	4240-01-330-7808		
Collective Prot Eq	4240-01-330-7809	C79375	
Collective Prot Eq: NBC HUB, M28	4240-01-395-5179		
Maintenance Kit, CBR Eq (for M28 System)	5180-01-331-2921		
Collective Prot Eq: M28	4240-01-331-2922	C52984	
Entrance, Protective, Pressurized (for M28 Sys)	4240-01-331-2938		
Entrance, Protective, Pressurized, M10	4240-00-229-2610	H10908	
Entrance, Protective, Pressurized, M12	4240-01-048-2923	E11043	

TABLE G-1. NBC DEFENSE EQUIPMENT (Continued)

ITEM NOMENCLATURE	NSN		BOI / CMT*
COLLECTIVE PROTECTION (Continued)			
DECONTAMINATION ITEMS	4240-01-331-2923		
Entrance, Protective, Pressurized, M13	4240-01-155-9971		
Entrance, Protective, Pressurized, M14	4240-01-105-5521	M0001	
Entrance, Protective, Pressurized, M15	4240-01-185-6786		
Entrance, Protective, Pressurized, M16	4240-01-240-4367		
Entrance, Protective, Pressurized, Ext, M18	4240-01-283-0193		
Entrance, Protective, Pressurized, Int, M19	4240-01-283-0192		
Entrance, Protective, Pressurized, Ext, M20	4240-01-283-0194		
Entrance, Protective, Pressurized, M277			
Filter Set, Gas Particulate, incl	4240-01-066-3266	NSNWAR	
Filter Set, Gas Particulate	4240-01-369-6533 (New)	NSNWAR	
	4240-01-067-5605 (Old)	NSNWAR	
	4240-01-066-3266		
Filter, Gas, M10	4240-00-256-9094	NSNWAR	
Filter, Gas-, 12 CFM	4240-01-365-0981 (New)		
Filter, Gas-, 12 CFM	4240-00-289-7978 (Old)		

Filter	4240-00-368-6291	NSNWAR	
Filter, Gas, M18	4240-01-365-0982 (New)		
Filter, Gas, M18	4240-00-828-3952 (Old)		
Filter, Particulate	4240-00-866-1825		
Filter, Gas	4240-01-363-1310 (New)		
Filter, Gas	4240-00-802-5170 (Old)		
Filter, Particulate, M24	4240-00-802-5169		
Gas Particulate Filter Unit, Stand Alone,M6A1	4240-00-889-2317	H48911	
Gas Particulate Filter Unit, Hospital, M7A1	4240-00-203-3999	H50418	
Gas Particulate Filter Unit, M8A3- ABC	4240-00-853-3201		
Gas Particulate Filter Unit, M9A2	4240-00-788-5310		

TABLE G-1. NBC DEFENSE EQUIPMENT (Continued)

ITEM NOMENCLATURE	NSN	LIN	BOI / CMT*
COLLECTIVE PROTECTION (Continued)			
Gas Particulate Filter Unit, Ambulance, M14	4240-00-010-5267	H48896	
Gas Particulate Filter Unit	4240-00-237-0227	H48904	
Gas Particulate Filter Unit	4240-00-237-0223		
Gas Particulate Filter Unit	4240-01-149-1719		
Gas Particulate Filter Unit	4240-01-192-7234		
Gas Particulate Filter Unit	4240-01-231-6515		
Gas Particulate Filter Unit	4240-01-274-6355		
Gas Particulate Filter Unit	4240-01-274-6356		
RADIAC EQUIPMENT			
Charger, RADIAC, PP1578 Detector	6665-00-542-1177	E00533	
Container Adapter A	6665-01-077-2986		
IM9E/PD, Radiac Meter	6665-00-243-8199		
IM93A/UD Radiac Meter	6665-00-752-7759	Q20935	
IM93B/UD Radiac Meter	6665-01-330-7520	Q20935	
RADIAC Set, AN/UDR-13	6665-01-407-1237	R31061	
Radiacmeter, IM174A/PD	6665-00-999-5145	Q21483	

Radiacmeter, IM174B/PD	6665-01-056-7422	Q21483	
RADIAC Set, AN/PDR- 27A		Q19339	
RADIAC Set, AN/PDR-27J	6665-00-543-1435	Q19339	
RADIAC Set, AN/PDR-27G	6665-00-543-1443	Q19339	
RADIAC Set, AN/PDR-27L	6665-00-856-3456	Q19339	
RADIAC Set, AN/PDR-27Q	6665-00-017-8903	Q19339	
RADIAC Set, AN/PDR-27R	6665-00-962-0846	Q19339	
RADIAC Set, AN/PDR-27P	6665-00-975-7222	Q19339	
RADIAC Set, AN/PDR-27S	6665-01-080-4418	Q19339	
RADIAC Set, AN/PDR-60	6665-00-965-1516	Q19750	
RADIAC Set, AN/PDR-56F	6665-01-113-9530	Q19681	
RADIAC Set, AN/PDR-75	6665-01-211-4217	R30925	

TABLE G-1. NBC DEFENSE EQUIPMENT (Continued)

ITEM NOMENCLATURE	NSN	LIN	BOI / CMT*
RADIAC EQUIPMENT (Continued)			
Detector, Radiac,	6665-01-043-2191		
RADIAC Set, AN/VDR-2	6665-01-222-1425	R20684	
* Basis of Issue (BOI): Prescribed by service logistics publications/directives.			

GLOSSARY

PART I—ABBREVIATIONS AND ACRONYMS

A

ABC America/Britian/Canada
AC hydrogen cyanide, a blood agent
ACAA automatic chemical agent alarm
ACADA automatic chemical agent detector system
AERP aircraft eye respiratory protection
AFJMAN Air Force joint manual
AFTTP air force tactics, techniques, and procedures
AMAD automatic chemical agent detector
AO area of operations
AOI area of interest
AOR area of responsibility
APC armored personnel carrier
APOD aerial port of debarkation
ATNAA antidote treatment nerve agent auto injector system

BDO battledress overgarment
BDU battledress uniform
BVO black vinyl overboot

C

C celsius
C2 command and control
CAM chemical agent monitor
CANA convulsant antidote for nerve agents
CAPDS chemical agent point detector system
CARC chemical agent resistant coating
CB chemical and biological
CBR chemical, biological, and radiological
CBPS chemically and biologically protected shelter
CCA contamination control area
CCM compartment control module
CDM chemical downwind message
Celsius centigrade
Centigray a unit of absorbed dose of radiation
CFM cubic feet per minute

CG phosgene, choking agent
cGy centigray
CK cyanogen chloride, a blood agent
COA course of action
COLPRO collective protection
COMM commercial
CONUS continental United States
CP command post
CPDEPMEDS chemically protected deployable medical system
CPE collective-protection equipment
CPFC chemical protective footwear cover
CPS collective protective shelter
CPO chemical protective undergarment
CVC combat vehicle crew
CW chemical warfare

D

DAP decontaminating apparatus portable
D days
Decon decontamination
DKIE decontaminating kit individual equipment
DOD Department of Defense
DSN doctrine switching network

E

ECWS extreme cold weather clothing system
EMP electromagnetic pulse
EOD explosive ordnance disposal
EPA environmental protection agency
EPW enemy prisoners of war

F

Fallout Precipitation to earth of radioactive particulate matter from a nuclear
FDECU field deployable environmental control unit
FFA fan filter assembly
FM field manual
FMFM Fleet Marine Force Manual
Ft feet

G

G2 assistant chief of staff, G2 (intelligence)
G3 assistant chief of staff, G3 (operations and plans)
GB sarin, a nerve agent
GPFU gas-particulate filter unit
GVO green vinyl overshoe

H

HAZCHEM hazardous chemical
HHA hand held assay
HN host nation
Hr hour
HSFC hermetically sealed filter container.
HSS health service support
HTH high test hypochlorite
HUMINT human intelligence
HVAC heating ventilation and air conditioning

I

ICAM improved chemical agent monitor
ICE individual chemical equipment
IFV infantry fighting vehicle
IHADSS integrated helmet and display sighting system
IPB intelligence preparation of the battlespace
IPE individual protective equipment
IPDS improved chemical agent detector system
ISR intelligence, surveillance, and reconnaissance
ITAP improved toxicological agent protective ensemble
Iwg inches water gage

J

JCAD joint chemical agent detector
J-FIRE joint-firefighter's integrated response ensemble
JP joint publication
JPACE joint protective aircrew ensemble
JRA joint rear area
JRAC joint rear area coordinator
JSGPM jointservice general purpose mask
JSLIST joint servce lightweight integrated suit technology

JTF joint task force
Kg kilogram

K

Kmph kilometer per hour
Kph kilometers per hour

L

LCE load-carrying equipment
Lethal deadly, fatal
Lethal Dose amount of toxic substance that has an absolutely fatal effect
LHA liquid hazard areas
LLR low level radiation

M

M meter
MBT main battle tank
MCC micro climate cooling
MCPE modular collective-protective equipment
MCWP Marine Corps warfighting publications
MCU marine corps units
MDMP military decisuon making process
m/s meter per second
METT-TC mission, enemy, terrain, troops, and time available and civilian considerations
MILSTRIP Military standard requisitioning and issue procedures
MK mark
MO Missouri
MOOTW military operations other than war
MOPP mission-oriented protective posture
Mph miles per hour.
MSR main supply route
MTF medical treatment facility
MTTP mutiservice tactics, techniques, and procedures
MULO multipurpose lightweight overboot
MUNITIONS Materials used in war, especially weapons and ammunition

N

NA not appliceable
NAAK nerve agent antidote kit
NAI named area of interest
NAPP nerve agent pretreatment pyridostigmine

NATO North Atlantic Treaty Organization
NAVMED Navy medical
NBC nuclear, biological, and chemical
NBCC nuclear, biological and chemical center
NBC-PC NBC protective cover
NBCWRS NBC warning and reporting system
NCO noncommissioned officer
NEO noncombatant evacuation operation
NTTP navy tactics techniques and procedures
nuclear warfare the employment of nuclear weapons
NWDC Naval Warfare Development Command
NWP naval warfare publication

O

OD olive drab
OOD officer of the deck
OEG operational exposure guide
OP observation post
OPLAN operations plan
OPORD operation order
OPR office of primary responsibility
OPSEC operations security
OPTEMPO operations tempo
OSHA Occupational Safety and Health Administrationm

P

PASGT personnel armor-system ground troop
PATS protective assessment test system
Pathogen A disease-producing microorganism
PE protective entrance
PMCS preventive maintenance checks and services
POE port of embarkation
POL petroleum, oils, and lubricants
PSYOP psychological operations
PT physical training
PVNTMED preventive medicine

Q

Qt quart

R

RCA riot control agent
Rd round.
RES **r**adiation exposure status
RI Rhode Island
ROE rules of engagement

RSOI reception, staging, onward movement, and integration
RTO radio telephone operator
SCALP suit, contamination avoidance and liquid protection
SCPE simplified collective-protection equipment
SOP standing operating procedure.
SPOD seaport of debarkation
SOF special operations forces

S

SAR supplied air respirator
SERPACWA skin exposure paste against chemical warfare agents
SCPE simplified collective protection equipment
SCBA self contained breathing apparatus
SDK skin decontaminating kit
SDS sorbent decontaminating system
SOP standing operating procedure
Sq square
STEPO self-contained toxic environment protective outfit
STB super tropical bleach

T

TAP toxicological agent protective
TEMPER
TEMP temporary
TFA toxic free area
TIC toxic industrial chemicals
TIM toxic industrial material
TM technical manual
TMD theater missile defense
TOE Table of organization and equipment
TTP tactics, techniques, and procedures

U

USA US Army
USMC United States Marine Corps
USAF United States Air Force
USN United States Navy

V

VB vapor barrier
(V) version
VB vapor barrier
VCA voice communications adapter
VGH relating to V- and G-type nerve agents and H-type blister agents
VHA vapor hazard area

W

WBGT wet bulb globe temperature

PART II – TERMS AND DEFINITIONS

Aerosol. a liquid or solid composed of finely divided particles suspended in a gaseous medium. Examples of common aerosols are mist, fogs, and smokes. (JP 3-11).

Avoidance. Individual and or unit measures taken to avoid or minimize nuclear, biological, or chemical attacks and reduce the effects of NBC hazards. (Joint Pub 1-02).

Contamination Control. Actions taken before an attack to protect resources from contamination, and actions taken after an attack to mark and avoid contamination. These measures reduce the amount and spread of contamination. (AFPAM-4005).

Biological agent. A microorganism that causes either disease in man, plants, or animals, or deterioration of material. (JP 1-02).

Biological defense. Methods, plans, and procedures involved in establishing and executing defensive measures against attack, utilizing biological agents. (JP 1-02).

Biological threat. A threat that consists of biological material planned to be deployed in order to produce casualties in personnel or animals or damage plants. (JP 1-02).

Biological weapons. An item of material that projects, disperses, or disseminates a biological agent, including arthropod vectors. (JP 1-02).

Blister agent. A chemical agent that injures the eyes and lungs and burns or blisters the skin. (JP 1-02).

Blood agent. A chemical compound, including the cyanide group, that affects bodily function by preventing the normal cultrization of oxygen from the blood to the body tissue. Also called cyanogen agent. (JP 1-02).

Chemical agent. Any toxic chemical intended for use in military operations. (JP 1-02).

Chemical ammunition. A type of ammunition, the filler of which is primarily a chemical agent. (JP 1-02).

Chemical defense. The methods, plans, and procedures involved in establishing and executing defensive measures against chemical agents. (JP 1-02).

Collective nuclear, biological and chemical protection. Protection provided to a group of individuals in a nuclear, biological and chemical environment which permits relaxation of individual nuclear, biological and chemical protection. (JP 1-02).

Combatant command. A unified or specified command with a broad continuing mission under a single commander established and so designated by the President, through the Secretary of Defense and with the advice and assistance of the Chairman of the Joint Chiefs of Staff. Combatant commands typically have geographic or functional responsibilities. (JP 1-02).

Contamination. The deposit, absorption or adsorption of radioactive material, or of biological or chemical agents on or by structures, areas, personnel, or objects; food and/or water made unfit for human or animal consumption by the presence of environmental chemicals, radioactive elements, bacteria, or organisms; the byproduct of the growth of bacteria or organisms in the decomposing material (including the food substance itself), or waste, in food or water. (JP 1-02).

Contamination control. Procedures to avoid, reduce, remove, or render harmless, temporarily or permanently, nuclear, biological, and chemical contamination for the purpose of maintaining or enhancing the efficient conduct of military operations. (JP 1-02).

Decontamination. The process of making any person, object, or area safe by absorbing, destroying, neutralizing, making harmless, or removing chemical or biological agents, or by removing radioactive material clinging to or around it. (JP 1-02).

Detection. In nuclear, biological, and chemical (NBC) environments, the act of locating NBC hazards by use of NBC detectors or monitoring and/or survey teams. (JP 1-02).

Host-nation support. Civil and/or military assistance rendered by a nation to foreign forces within its territory during peacetime, crisis or emergencies, or war based on agreements mutually concluded between nations. (JP 1-02).

Individual protection. Actions taken by individuals to survive and continue the mission under nuclear, biological, and chemical conditions. (JP 1-02).

Individual protective equipment. NBC warfare, the personnel clothing and equipment required for CB hazards and some nuclear effects. (JP 1-02).

Industrial chemicals. Chemicals developed or manufactured for use in industrial operations or research by industry, government, or academia. These chemicals are not primarily manufactured for the specific purpose of producing human casualties or rendering equipment, facilities, or areas dangerous for human use. Hydrogen cyanide, cyanogen chloride, phosgene, and chloropicrin are industrial chemicals that also can be military chemical agents. (JP 1-02).

Mission-oriented protective posture. A flexible system of protection against NBC contamination. This posture requires personnel to wear only that protective clothing and equipment (MOPP gear) appropriate to the threat level, work rate, imposed by the mission, temperature, and humidity. Also called MOPP (JP 1-02).

Mission-oriented protective posture gear. Military term for individual protective equipment including suit, boots, gloves, mask with hood, first aid treatments, and decontamination kits issued to soldiers. Also called MOPP gear. (JP 1-02).

Nerve agent. A lethal chemical that causes paralysis by interfering with the transmission of nerve impulse. (JP 1-02).

Nonpersistent agent. A chemical agent that, when released, dissipates and/ or loses its ability to cause casualties after a passage of 10 to 15 minutes. (FM 3-4).

Nuclear, biological, and chemical capable nation. A nation that has the capability to produce and employ one or more types of nuclear, biological, and chemical weapons across the full range of military operations and at any level of war in order to achieve political and military objectives. (JP 1-02).

Nuclear, biological, and chemical defense. Defensive measures that enable friendly forces to survive, fight, and win against enemy use of nuclear, biological, or chemical (NBC) weapons and agents. US forces apply NBC defensive measures before and during integrated warfare. In integrated warfare, opposing forces employ nonconventional weapons along with conventional weapons (NBC weapons are nonconventional). (JP 1-02).

Nuclear, biological, and chemical environment. Environments in which there is deliberate or accidental employment, or threat of employment of NBC weapons; deliberate or accidental attacks or contamination with TIM, including TIC; or deliberate or accidental attacks or contamination with radiological materials. (JP 1-02).

Persistency. A measure of the ability of NBC weapons to continue in their casualty-producing effects after they have been released and downwind for indefinite distances. (JP 1-02).

Nuclear defense. The methods plans, and procedures involved in establishing and exercising defensive measures against the effects of an attack by nuclear weapons or radiological warfare agents, it encompasses both the training for and implemination of the methods, plans, and procedures. (JP 1-02).

Protection. Measures that are taken to keep NBC hazards from having an adverse impact on personnel, equipment, critical assets or facilities. Protection consists of five groups of activities: hardening of positions, assuming MOPP, using physical defense measures, and reacting to attack. (JP 1-02).

Residual Contamination. That amount that remains after steps have been taken to remove it. These steps may consist of nothing more than allowing the contamination to decay normally. (JP 1-02).

Survey. The directed effort to determine the location and the nature of a chemical, biological, and radiological hazard in an area. (JP 1-02).

Toxic Chemical. Any chemical which, through its chemical action on life processes, can cause death, temporary incapacitation, or permanent harm to humans or animals. This includes all such chemicals, regardless of their origin or of their method of production, and regardless of whether they are produced in facilities, in munitions or elsewhere. (JP 1-02).

Vector. A carrier; especially the animal or intermediate host that carries a pathogen from one host to another, as the malaria-carrying mosquito. (JP 1-02).

Ventilated Vacepiece. A series of individual respiration systems or masks serviced by a common filter system. (JP 1-02).

Weapons Of Mass Destruction. In arms control usage, weapons that are capable of a high order of destruction and/or of being used in such a manner as to destroy large numbers of people. Can be nuclear, chemical, biological, and radiological weapons, but excludes the means of transporting or propelling the weapon where such means is a separable and divisible part of the weapon. (JP 1-02).

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